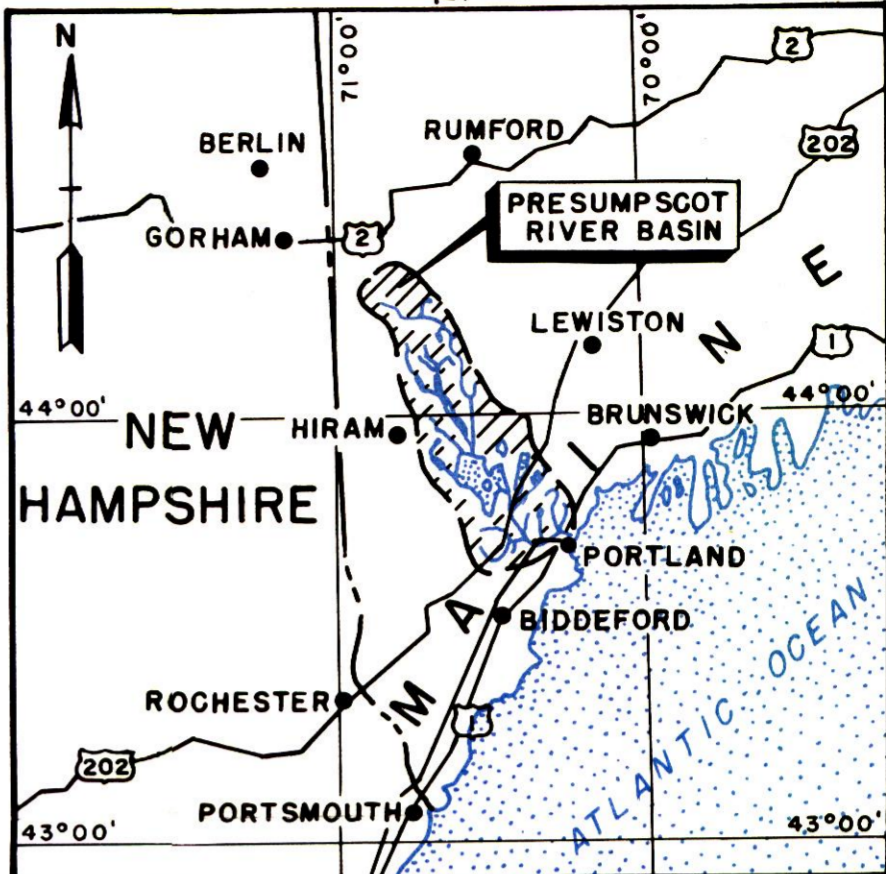
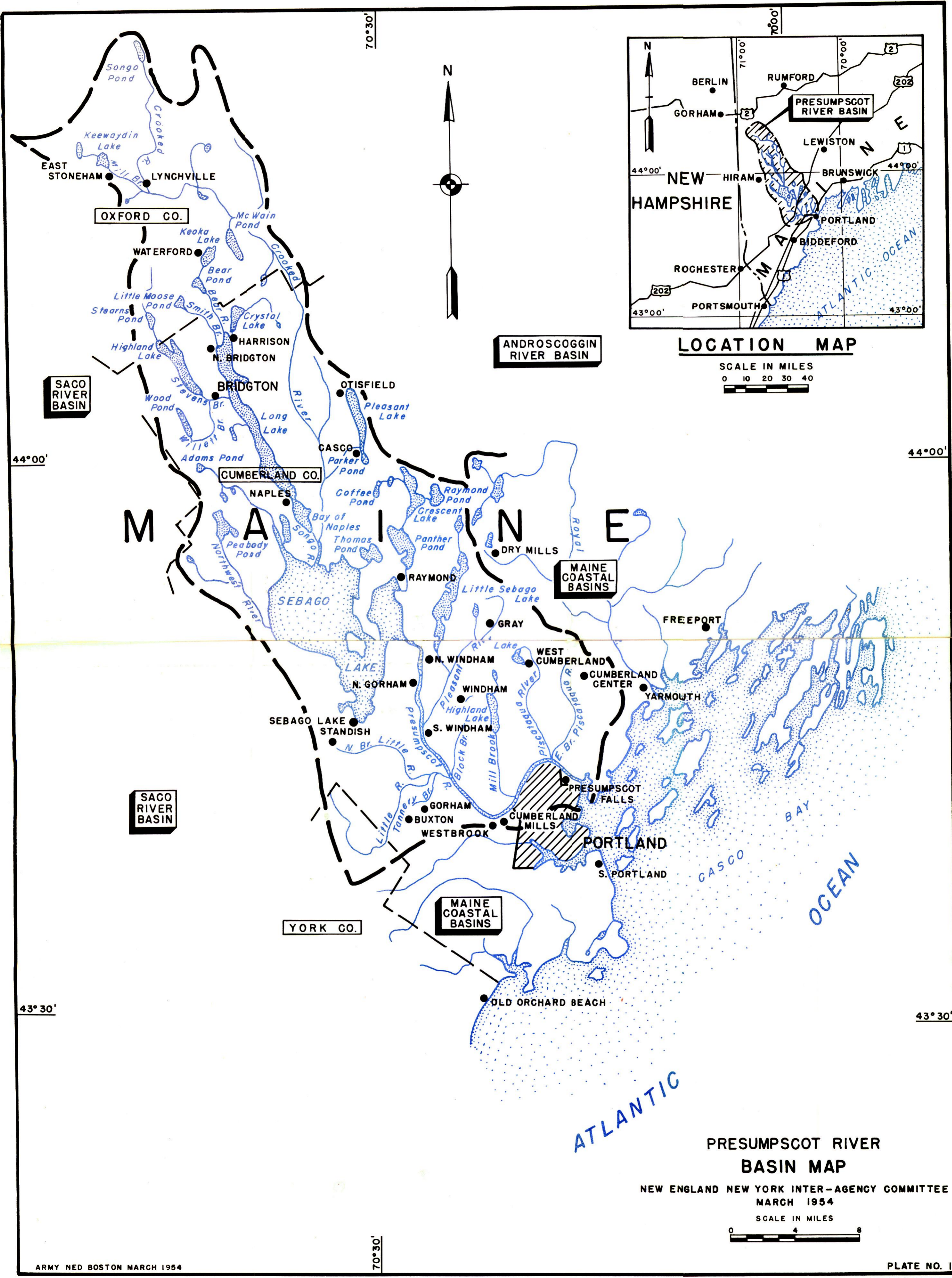


**PRESUMPSCOT RIVER  
BASIN MAP**

**NEW ENGLAND - NEW YORK INTER-AGENCY COMMITTEE**



**LOCATION MAP**

SCALE IN MILES  
0 10 20 30 40

**PRESUMPSCOT RIVER  
BASIN MAP**

NEW ENGLAND NEW YORK INTER-AGENCY COMMITTEE  
MARCH 1954

SCALE IN MILES



## FOREWORD

This book contains one chapter of Part Two of the Report of the New England-New York Inter-Agency Committee, organized by direction of the President of the United States for the purpose of making a comprehensive survey of the land, water and related resources of the New England-New York Region.

The complete report comprises three parts:

Part One - The General Report.

Part Two - The Technical Report, with detailed studies of the river basins and special subjects.

Part Three - Reference Data.

THE RESOURCES  
OF THE  
NEW ENGLAND-NEW YORK REGION

CONTENTS

Part Two

Chapter I	- The New England-New York Region
Chapter II	- Subregion "A"
Chapter III	- Saint John River Basin
Chapter IV	- St. Croix River Basin
Chapter V	- Penobscot River Basin
Chapter VI	- Kennebec River Basin
Chapter VII	- Androscoggin River Basin
Chapter VIII	- Presumpscot River Basin
Chapter IX	- Saco River Basin
Chapter X	- Maine Coastal Area
Chapter XI	- Special Subjects Subregion "A"
Chapter XII	- Subregion "B"
Chapter XIII	- Piscataqua River Basin
Chapter XIV	- New Hampshire Coastal Area
Chapter XV	- Merrimack River Basin
Chapter XVI	- Massachusetts Coastal Area
Chapter XVII	- Narragansett Bay Drainage Basins
Chapter XVIII	- Pawcatuck River Basin

Chapter XIX	- Rhode Island Coastal Area
Chapter XX	- Thames River Basin
Chapter XXI	- Connecticut River Basin
Chapter XXII	- Housatonic River Basin
Chapter XXIII	- Connecticut Coastal Area
Chapter XXIV	- Special Subjects Subregion "B"
Chapter XXV	- Subregion "C"
Chapter XXVI	- Lake Memphremagog Drainage Basin
Chapter XXVII	- Lake Champlain Drainage Basin
Chapter XXVIII	- St. Lawrence Drainage Basin
Chapter XXIX	- Special Subjects Subregion "C"
Chapter XXX	- Subregion "D"
Chapter XXXI	- Black River Basin
Chapter XXXII	- Oswego River Basin
Chapter XXXIII	- Genesee River Basin
Chapter XXXIV	- Small Streams Tributary to Lake Ontario
Chapter XXXV	- Lake Erie - Niagara River Drainage Basin
Chapter XXXVI	- Special Subjects Subregion "D"
Chapter XXXVII	- Subregion E - Hudson River Basin
Chapter XXXVIII	- Special Subjects Subregion "E"
Chapter XXXIX	- Special Subjects, Regional

**THE RESOURCES  
OF THE  
NEW ENGLAND-NEW YORK REGION**

**PART TWO**

**CHAPTER VIII**

**PRESUMPCOT RIVER BASIN  
MAINE**

**NEW ENGLAND - NEW YORK INTER-AGENCY COMMITTEE**

# PRESUMPSCOT RIVER BASIN

## CONTENTS

### Page

#### SECTION I - GENERAL DESCRIPTION

BASIN - Location and area.	1
RIVER - Origin and course, Tributaries.	1
TOPOGRAPHY AND GENERAL GEOLOGY - Topography, Bedrock, Surficial geology.	3
MAPS -	5
CLIMATE AND HYDROLOGY - General, Temperature, Pre- cipitation, Snowfall, Stream flow, Run-off	6

#### SECTION II - ECONOMIC DEVELOPMENT

Background, Population, Economy, Transportation	1
---	---

#### SECTION III - STORAGE AND STREAM FLOW REGULATION

Existing storage, operation and regulation.	1
---	---

#### SECTION IV - WATER SUPPLY

SURFACE WATER AVAILABLE - Safe yields, Uncontaminated quality, Sanitary quality.	1
GROUND WATER AVAILABLE - Yields from bedrock, Yields from unconsolidated deposits, Quality	6
WATER USE - Rural and agricultural, Municipal and industrial, Industrial water use, Surface water use, Ground water use, Reuse.	8
DISCUSSION OF FUTURE WATER RESOURCES - Future trends, Future quality.	12
CONTROL OF RESERVOIRS FOR PUBLIC WATER SUPPLIES -	14
CONCLUSIONS -	14
WATER SUPPLY PLAN -	16

SECTION V - POLLUTION CONTROL

POLLUTION CONTRIBUTED TO WATER RESOURCES - Sewage and industrial waste pollution. Other pollution factors.	1
EFFECTS OF POLLUTION ON PRESENT WATER QUALITY - Effects on main stem of Presumpscot River, North Branch, Little River, Tannery Brook, Stevens Brook, Highland Lake and Bay of Naples, Effects of pollution on shellfish areas, Effects of pollution on agricultural uses, Water unaffected by pollution.	4
POLLUTION PREVENTION MEASURES IN EFFECT - Treatment facilities in operation, Maine State pollution control legislation. Surface waters classified by Maine Legislature.	10
PROVISIONAL POLLUTION CONTROL, COSTS AND BENEFITS - Purpose of provisional plans, Essence of provisional plans, Cost estimate criteria, Water quality criteria.	11
PROVISIONAL PLAN A - Treatment or disposal facilities, Reduction in pollution load, Approximate water quality improvement, Net water quality improvement, Costs for treatment and disposal facilities, Annual charges for public sewage treatment, Annual charges for private sewage treatment, Annual charges for industrial waste treatment.	16
PROVISIONAL PLAN B - Treatment or disposal facilities, Reduction in pollution load, Approximate water quality improvement, Net water quality improvement, Costs for treatment and disposal facilities, Annual charges for public sewage treatment, Annual charges for industrial waste treatment.	25

	<u>Page</u>
PROVISIONAL PLAN C -	34
Treatment or disposal facilities, Reduction in pollution load, Approximate water quality improvement, Net water quality improvement, Costs for treatment and disposal facilities, Annual charges for public sewage treatment, Annual charges for industrial waste treatment.	
BENEFITS RESULTING FROM WATER QUALITY IMPROVEMENT -	40
Tangible and intangible benefits, water uses potentially to be benefited, Potential benefits in Presumpscot River Basin; Resource development and benefits.	
EVALUATION OF MONETARY BENEFITS OR LOSSES TO POLLUTION CONTROL FROM CONSERVATION AND DEVELOPMENT PROJECTS - Power projects, Other conservation projects.	46
SECTION VI - FLOOD CONTROL AND DRAINAGE	
HISTORY AND ANALYSIS OF FLOODS - Flood history, Analysis of floods.	1
DAMAGES - Erosion damages, Sedimentation damages, Total damages, Basin requirements.	2
PLANS OF DEVELOPMENT - Existing flood control improvements, Effect of land treatment program.	3
BENEFITS -	4
SUMMARY AND CONCLUSIONS - Summary.	5
DRAINAGE -	6
SECTION VII - POWER DEVELOPMENT	
AVAILABLE POWER - Existing developments, Power supply.	1
HYDROELECTRIC POWER PLAN -	3

	<u>Page</u>
SECTION VIII - NAVIGATION	1
SECTION IX - FISH AND WILDLIFE	
THE RESOURCES - Wildlife resources, Fishery resources.	1
NEEDS OF THE FISH AND WILDLIFE RESOURCES - Wildlife resources, Fishery resources.	10
COORDINATION WITH OTHER LAND AND WATER DEVELOPMENT PROGRAMS -	20
FISH AND WILDLIFE PLAN - Plan.	20
SECTION X - RECREATION	
THE RESOURCE - Natural features of recreation importance, Historical and archeological features.	1
PRESENT USE OF THE RECREATION RESOURCES - Public parks and recreation areas, Private recreation developments.	2
RECREATION NEEDS AND POTENTIALITIES -	6
PLAN FOR DEVELOPMENT OF THE RESOURCES FOR RECREATION - General discussion of the plan, Provisions of the plan, Benefits of the plan.	9
SECTION XI - LAND MANAGEMENT -	1
SECTION XII - MINERALS	
INTRODUCTION -	1
MINERAL COMMODITIES - Andalusite, Clay, Crushed stone, Peat, Pegmatite Minerals (beryl, feldspar, mica, quartz), Sand and gravel.	3
MINERALS PLAN -	7
SELECTED BIBLIOGRAPHY -	8

## SECTION XIII - INSECT CONTROL

### Page

PRESENT STATUS OF INSECTS ADVERSE TO PUBLIC  
HEALTH AND THEIR CONTROL - Disease and vector  
problem, The pest insect problem,  
Mosquitoes, Ticks, Black flies, Deer flies  
and horseflies, Punkies. 1

BENEFITS AND COSTS OF INSECT CONTROL - 9

EFFECTS OF WATER RESOURCES DEVELOPMENTS ON  
INSECTS - Development of recreation areas. 11

CONCLUSIONS - 12

INSECT CONTROL PLAN - 13

## SECTION XIV - COORDINATED BASIN PLAN

GENERAL DISCUSSION - Storage and stream  
flow regulation, Water supply, Pollution  
control, Flood control and drainage,  
Power development, Navigation, Fish and  
wildlife, Recreation, Land management,  
Minerals, Insect control. 1

VIEWS OF LOCAL INTERESTS - 4

FEATURES OF THE COORDINATED BASIN PLAN - 5

APPRAISAL OF THE COORDINATED BASIN PLAN -  
Water supply, Pollution control, Fish and  
wildlife, Recreation, Minerals, Insect  
control. 8

RECOMMENDATION - 11

# PRESUMPSCOT RIVER BASIN

## LIST OF TABLES

<u>Table</u>		<u>Page</u>
SECTION I - GENERAL DESCRIPTION		
1	Mean monthly and annual temperatures -	7
2	Mean monthly and annual precipitation -	8
3	Average annual snowfall -	9
4	Stream flow record -	10
SECTION II - ECONOMIC DEVELOPMENT		
5	Population of cities and towns having over 1000 inhabitants in 1950 -	2
SECTION III - STORAGE AND STREAM FLOW REGULATION		
6	Available storage -	1
SECTION IV - WATER SUPPLY		
7	Chemical and physical characteristics of untreated water supplies -	3
8	Summary of known present effects of industrial and municipal pollution on fresh stream water quality -	5
9	Water used and water supplied -	19
SECTION V - POLLUTION CONTROL		
10	Sources of pollution--municipal -	3
11	Sources of pollution--industrial -	3
12	Approximate effects of pollution on present water conditions	8
13	Treatment and disposal facilities - Provisional Plan A -	17
14	Approximate effects of Provisional Plan A on water conditions -	19
15	Provisional Plan A - Approximate present stream conditions and approximate stream conditions resulting from treatment or disposal -	21

<u>Table</u>		<u>Page</u>
16	New England Interstate Water Pollution Control Commission Tentative Plan for Classification of Waters -	follows 22
17	Summary of estimated construction costs and annual charges for treatment and disposal facilities - Provisional Plan A	25
18	Treatment and disposal facilities - Provisional Plan B -	26
19	Approximate effects of Provisional Plan B on water conditions -	28
20	Provisional Plan B--Approximate present stream conditions and approximate stream conditions resulting from treatment or disposal -	30
21	Summary of estimated construction costs and annual charges for treatment and disposal facilities--Provisional Plan B	33
22	Treatment and disposal facilities - Provisional Plan C -	34
23	Provisional Plan C--Approximate present stream conditions and approximate stream conditions resulting from treatment or disposal -	36
24	Summary of estimated construction costs and annual charges for treatment or disposal facilities - Provisional Plan C -	40
25	Basic data on sources of municipal and industrial pollution -	47
	SECTION VI - FLOOD CONTROL AND DRAINAGE	
26	Annual damages -	3
27	Summary of benefits -	5

TablePage

## SECTION VII - POWER DEVELOPMENT

28	Existing hydro-power plants -	2
29	Inter-connected generating capacity of the Central Maine Power Company -	3

## SECTION X - RECREATION

30	Estimated costs of recreation development plan -	11
----	---	----

## SECTION XIII - INSECT CONTROL

31	Approximate densities of important pest species -	6
32	Population centers where organized insect control programs may be desirable -	7

# PRESUMPCOT RIVER BASIN

## LIST OF PLATES

### Plate

1 Basin Map Frontispiece

Follows page

### SECTION IV - WATER SUPPLY

2	Surface Water Supply -	2
3	Average Weekly Air and Water Temperature -	4
4	Expected Yield of Wells -	6
5	Ground Water Hardness -	8
6	Total Daily Water Use -	10
7	Water Consumption and Population Trends -	12

### SECTION V - POLLUTION CONTROL

8	Approximate Present Stream Conditions -	6
9	Plan A - Approximate Water Conditions -	20
10	Plans B and C - Approximate Water Conditions -	32

### SECTION VII - POWER DEVELOPMENT

11	Index to Sites -	4
12	Presumpscot River Profile -	4
13	Presumpscot River Profile -	4

### SECTION X - RECREATION

13a	Parks and Recreation Areas -	12
-----	------------------------------	----

### SECTION XII - MINERALS

14	Locations of mineral deposits -	Faces 3
----	---------------------------------	---------

PRESUMPSCOT RIVER BASIN

LIST OF PHOTOGRAPHS

	Follows page
Recreation use of a Public Wayside Area-	II-2
Use of the Presumpscot River Canoe Route -	X-2
Bathing Beach, Sebago Lake State Park -	X-4
Boating at Sebago Lake State Park -	X-6
Keewaydin Lake offers an excellent opportunity for development of a public recreation area -	X-8

## SECTION I - GENERAL DESCRIPTION

### BASIN

1. Location and area. - The Presumpscot River Basin is located in the southwestern part of Maine, between the watersheds of the Androscoggin River to the north and east, Maine Coastal Streams to the south, and the Saco River to the west. It has a maximum length in a northwest-southeast direction of about 55 miles, a maximum width of about 20 miles near its lower end, and a total area of 648 square miles. The lake-and-pond area in the basin covers about 81 square miles or over 12 percent of the total watershed. Sebago Lake, covering 45 square miles and draining an area of 436 square miles, is the largest body of water in the basin.

### RIVER

2. Origin and course. - The Presumpscot River originates at Sebago Lake, in the towns of Standish and Windham, Maine, and follows a meandering but general southeasterly course for about 24 miles to its mouth at Casco Bay, between Falmouth and Portland. From its source the river flows first in a southerly direction for about seven miles and then southeasterly another seven miles to Westbrook. Here it turns and flows northeast for about six miles before turning again and flowing generally southeast and then south to its mouth. The total fall in the river is 267 feet

of which 250 feet have been developed at nine power plants located between 2.7 and 22.7 miles above its mouth. The lower 2.7 miles of the river are tidal with a mean tidal range of 8.9 feet. A profile of the main Presumpscot River is shown on plates 12 and 13.

3. Tributaries. - The principal tributary to Sebago Lake is the Songo River. Tributary to the Songo River are Long Lake and the Bay of Naples, otherwise known as Brandy Pond, and the Crooked River. Long Lake is an elongated, narrow lake, with a north-south length of about 11 miles and a surface area of 9.55 square miles, which drains an area of 115 square miles in the upper western part of the Presumpscot River watershed. The flow from Long Lake empties into the Bay of Naples, a body of water about two miles long covering approximately 1.2 square miles, and then follows the abruptly winding course of the Songo River for about 3.25 miles in a southerly direction to Sebago Lake. The Crooked River rises in Songo <sup>Pond</sup> Lake, in the uppermost part of the basin, and flows in a general southeasterly direction along a meandering course for about 35 miles to its mouth at the Songo River. The Crooked River has a total fall of 382 feet and drains an area of 151 square miles in the northern and upper eastern part of the basin.

4. The principal tributaries of the main Presumpscot River are the Pleasant and Piscataqua Rivers. The Pleasant River rises in the hilly region south of Gray and flows in a southwesterly

direction for about 14 miles to its confluence with the Presumpscot River six miles below Sebago Lake. This tributary area amounts to about 48 square miles including 19 square miles drained by Little Sebago Lake. The Piscataqua River rises in the northwestern part of Cumberland and follows a general southerly course for about 12 miles to its junction with the Presumpscot River about one mile above tidewater. It drains an area of about 20 square miles.

#### TOPOGRAPHY AND GENERAL GEOLOGY

5. Topography. - The headwater lakes, including Keewaydin Lake and Songo Pond, of the Crooked River in the northernmost portion of the basin, lie at elevations of from 650 to over 800 feet, mean sea level, with surrounding hills and subdued mountains rising 600 to 1,000 feet above them. Lakes in the system draining the upper western part of the basin, including Keoka and Highland Lakes, have water surfaces at various elevations between 555 and 268 feet, mean sea level, which is the elevation of Long Lake. These lakes are connected by short, steep streams in narrow valleys with relief generally less than 500 feet. The area around Sebago Lake, elevation 267 feet, and southward to the ocean is a gently undulating plain, into which the streams have cut gully-like, shallow valleys. The relief in this area is generally less than 150 feet. Forests of mixed conifers and hardwoods in various stages of growth occupy about 80 percent of the basin.

6. Bedrock. - The bedrock of the basin consists of hard, crystalline rocks, mostly schist, gneiss and granite. The granite is found in a belt extending northeast-southwest across the basin, including almost all the area of Sebago Lake. Schist and gneiss occur throughout the rest of the basin, both north and south of the granitic belt. Pegmatite, a coarse-grained, granite-like rock, is found cutting the schist and gneiss in some areas in the northern and northeastern parts of the basin.

7. Surficial geology. - The basin is blanketed by glacial till composed of variable silty, gravelly sand with cobbles and boulders. The till is generally thick in the valleys and on the lower hills, but it thins out or is entirely absent on the higher, steep slopes. The till is also absent at locations where down-cutting streams have uncovered the rock crest of old pre-glacial divides, or bedrock spurs high on old valley walls. In the valley bottoms the till is generally buried under glacial outwash. Around Sebago Lake, where the topographic relief is low, the outwash is widespread. Kames and terraces occur along many of the valley slopes above the outwash plains below Sebago Lake. The till in the lower part of the basin, from the vicinity of Gorham and Westbrook to the sea, is buried under marine clay which was deposited during the invasion by the sea that

occurred following the recession of the glacier from the New England coast. The soils which have developed in these surficial deposits are Podzols and Brown Podzolic soils. A discussion of these soils is contained in Section XI, Chapter X - Maine Coastal Area.

#### MAPS

8. The U. S. Geological Survey has published standard topographic quadrangle sheets, scale 1:62,500, covering the entire watershed of the Presumpscot River, and a general map of the State of Maine, scale 1:500,000. It has also prepared maps covering the coastal area of the basin at a scale of 1:24,000. The Army Map Service has issued two topographic maps entitled Lewiston (NL-19-10) and Portland (NK 19-1), scale 1:250,000, which afford coverage of all the watershed. The basin is shown on sheets 5 and 6 of the Maine Transportation Maps, scale 1:250,000, issued by the Bureau of Public Roads. General highway maps prepared by the State Highway Commission in cooperation with the Public Roads Administration showing stream patterns, cultural features and other details, are available for the entire basin. The tidal section of the river and adjacent areas are shown on U. S. Coast and Geodetic Survey Charts Nos. 325, 315 and 1204. The extent of geologic mapping in this basin is discussed in Section XII.

## CLIMATE AND HYDROLOGY

9. General. - The Presumpscot River Basin has a climate characterized by four fairly distinct seasons of variable weather conditions. Winters are cold and snowy and summers warm. Precipitation is fairly evenly distributed throughout the year. The basin lies in the path of the "prevailing westerlies" and the cyclonic storms that move across the country from the west and southwest toward the east and northeast. It is also exposed to occasional coastal storms, some of tropical origin, that travel up the Atlantic Seaboard. These coastal storms, although heavily laden with moisture from the ocean, lose much of their original violence before reaching Maine.

10. Temperature. - Average annual temperatures throughout the basin range from about 45° F near the coast to less than 42° F in the headwater areas. The range of average monthly temperatures between the coldest and warmest months is about 50° F. Daily temperature extremes range from winter minimums of minus 25° or lower to summer maximums in the 90's. The growing season for vegetation averages about 150 days. The mean monthly temperatures at four stations in or near the Presumpscot River Basin are summarized in Table 1.

Table 1 - Mean monthly and annual temperatures,  
Presumpscot River Basin and vicinity  
 (Degrees Fahrenheit)

<u>Station</u>	<u>Rumford Maine</u>	<u>N, Bridgton Maine</u>	<u>Lewiston Maine</u>	<u>Portland Maine</u>
<u>Years of Record</u>	51	43	65	12
<u>Elevation (m.s.l.)</u>	505	450	182	60
<u>Month</u>				
January	17.2	18.6	18.7	21.1
February	17.9	19.7	19.2	22.7
March	28.9	30.5	29.9	32.3
April	40.9	42.5	41.4	42.9
May	53.2	52.9	54.1	52.7
June	62.6	63.2	63.7	62.2
July	68.3	69.3	69.5	68.7
August	65.5	66.5	67.4	67.0
September	57.9	59.8	59.8	58.9
October	47.1	49.1	48.6	49.2
November	34.3	37.2	36.0	38.3
December	22.0	24.3	23.6	26.1
Annual	43.0	44.5	44.3	45.2

11. Precipitation. - The average annual precipitation for the watershed is about 43 inches and it is distributed rather uniformly throughout the year. Geographically, the average annual precipitation varies from a minimum of less than 42 inches in the lower basin to a maximum of 44 inches at areas of higher elevation found in the upper reaches. At any one location the range between maximum and minimum values of average monthly precipitation is about one inch. Average monthly rainfalls of North Bridgton range from a minimum of 3.03 inches in February

to a maximum of 4.11 inches in July; and at Portland, Maine, from 3.09 in August to 3.99 in January. The records of precipitation at five U. S. Weather Bureau stations in or near the basin are summarized in Table 2.

Table 2 - Mean monthly and annual precipitation,  
Presumpscot River Basin and vicinity  
(Inches)

<u>Station</u>	<u>Rumford Maine</u>	<u>N. Bridgton Maine</u>	<u>Lewiston Maine</u>	<u>Hiram Maine</u>	<u>Portland Maine</u>
<u>Years of Record</u>	57	43	76	23	82
<u>Elevation</u> (ft.) (msl)	505	450	182	375	60
<u>Month</u>					
January	3.00	3.42	3.92	3.75	3.99
February	2.76	3.30	3.61	3.08	3.01
March	3.49	3.83	4.30	3.47	3.97
April	3.32	3.41	3.58	4.16	3.47
May	3.28	3.51	3.35	2.96	3.41
June	3.44	3.54	3.41	3.56	3.31
July	3.71	4.11	3.62	3.64	3.17
August	3.44	3.57	3.12	3.20	3.09
September	3.70	3.65	3.69	3.80	3.17
October	3.21	3.16	3.55	3.28	3.18
November	3.30	3.57	3.74	3.95	3.71
December	2.98	3.40	3.90	3.32	3.81
Annual	39.63	42.47	43.79	42.17	42.09

12. Snowfall. - The precipitation over the basin during the winter months is mostly in the form of snow with annual snowfall varying from about 70 inches near the coast to an extreme of well over 100 inches in the higher elevations of

the headwater regions. The water content of the snow cover over the basin in the early spring often amounts to four to six inches with over six inches being quite common in the upper areas of the watershed. Table 3 indicates the average annual snowfall at four locations in or near the basin.

Table 3 - Average annual snowfall,  
Presumpscot River Basin and vicinity

<u>Station</u>	<u>Elevation</u> (feet m.s.l.)	<u>Years of</u> <u>record</u>	<u>Average</u> <u>snowfall</u> Inches
Rumford, Maine	505	91	90
Hiram, Maine	375	14	89
Lewiston, Maine	182	83	85
Portland, Maine	60	71	72

13. Stream flow. - There is only one gaging station in the Presumpscot River Basin. It is at the outlet of Sebago Lake where the drainage area is 436 square miles or about 70 percent of the total area of the basin. The flow at this point is completely controlled by Sebago and other lakes. Flow records at this gaging station, from data furnished to the U. S. Geological Survey by the S. D. Warren Company, are summarized in Table 4.

Table 4 - Stream flow record,  
Presumpscot River Basin

Location of gaging station	Drainage area sq. mi.	Period of record	Discharge		
			Mean	Maximum*	Minimum**
			cubic feet per second		
Outlet Sebago Lake	436	1887-1951	641	7,000 (Apr. 1902) 3,780 (Apr. 1936)	159 (Aug. 1911) 189 (Mar. 1942)

\*Instantaneous

\*\*Minimum monthly, regulated by controlled storage.

Other records indicate that a maximum discharge of 13,800 cubic feet per second was experienced in March 1896 at the Cumberland Mills dam in Westbrook. At that time, the combined discharge from Sebago and Little Sebago Lakes was but 370 c.f.s. The next highest flow at this point, with drainage area of 570 square miles, was 11,200 c.f.s. in March 1936.

14. An examination of available data indicates that two extended dry periods were experienced during the eleven-year period from October 1940 to September 1951, as follows: (1) from July 1941 to April 1942 when the flow averaged 243 cubic feet per second or 38 percent of the average annual flow for the 64 years of record, and (2) from July 1949 to April 1950 when the flow averaged 360 c.f.s. or 56 percent of the 64-year average annual flow. The period of maximum stream flow during these same eleven years extended from May 1945 to February 1946 when an average flow of 946 c.f.s. was experienced.

15. Run-off. - The annual run-off in the Presumpscot River Basin above the outlet of Sebago Lake has averaged 20 inches (1.5 c.f.s. per square mile) or slightly under 50 percent of the average

annual precipitation. The monthly distribution of the run-off shows remarkable uniformity throughout the year due to the regulation afforded by Sebago Lake.

## SECTION II - ECONOMIC DEVELOPMENT

1. Background. - The early development of the Presumpscot River Basin followed much the same pattern as that of other basins in southern Maine. Settlement began near the coast in the 1630's with fishing, fur trading, local lumbering and subsistence farming as the principal activities. Expansion of settlement and lumbering toward the interior was delayed by Indian raids, and the ever present threat of these raids, until the fall of Canada to the British in 1760. Thereafter, settlement was pushed inland closely following lumbering operations, and general farming became a principal activity in the cleared areas. Lumbering operations reached their peak early in the 1800's and tapered off gradually thereafter. The center of economic activity then shifted to the lower basin and the environs of Portland where industries and commercial enterprises had gained a foothold. Later in the 19th century, the recreational attractions of the basin were recognized and a tourist resort business began to flourish, thus rejuvenating the economy of the central and upper portions of the basin. This relationship between the central and upper portions of the basin and the lower basin remains as such today.

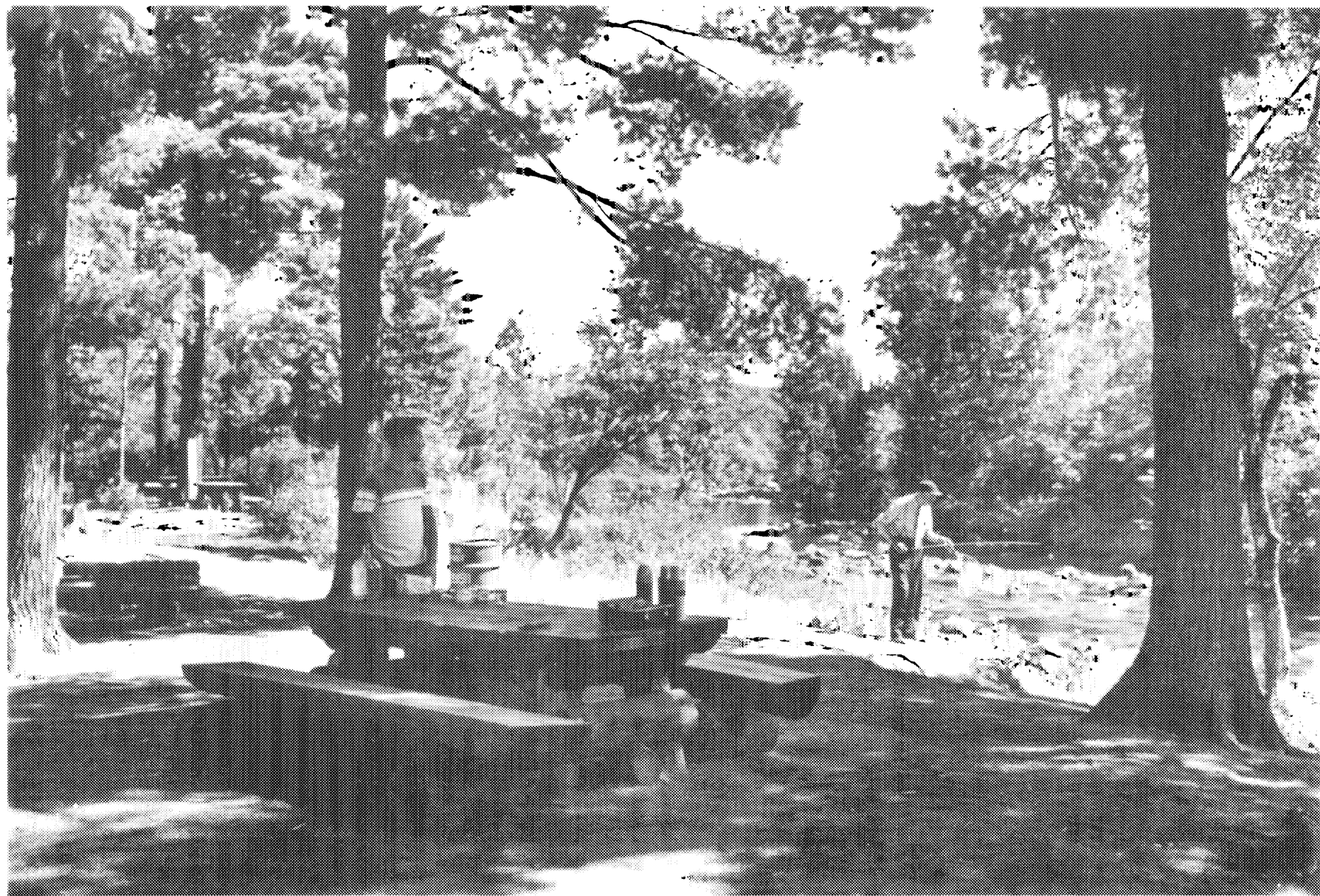
2. Population. - The population in the Presumpscot River Basin in 1950 was an estimated 34,400, an increase of 15 percent over the 1940 population. Approximately 71 percent of the inhabitants live

in the six cities and towns adjoining the main river below the outlet of Sebago Lake. The largest city is Westbrook, with a 1950 population of 12,284. Only a small part of the city of Portland is within the watershed limits. However, this city, with its large population, industry, and commerce, has a significant influence on the economy of the Presumpscot River Basin. Of the 24 cities and towns located wholly or in part within the watershed, the nine listed in Table 5 account for over 83 percent of the total basin population.

Table 5 - Population of cities and towns having over 1,000 inhabitants in 1950, Presumpscot River Basin

<u>City or town</u>	<u>Total population</u>	<u>Estimated population in basin</u>
Bridgton	2,950	2,750
Buxton	2,009	1,189
Falmouth	4,342	2,171
Gorham	4,742	2,371
Gray	1,631	1,000
Harrison	1,026	1,026
Portland	77,634	2,500
Westbrook	12,284	12,000
Windham	<u>3,434</u>	<u>3,434</u>
Total	110,052	28,441

3. Economy. - Industry has been developed to a small extent in this basin. Bridgton, Waterford, Windham, Cumberland, and Westbrook are the chief manufacturing towns. The principal industrial products are lumber and wood products, bricks, leather goods, textiles, and paper. Over 50 percent of the industrial establishments are devoted to milling and woodworking.



Recreation use of a Public Wayside Area. Presumpscot River Basin .

4. Agriculture is one of the more important activities in the basin. Farm income is derived principally from the sale of dairy and poultry products. About one-fifth of the watershed is cleared farmland. The remainder of the basin is mostly cut-over forest land of mixed hardwoods and conifers.

5. The recreational facilities of the basin, especially in the Sebago Lake district, are intensively utilized. Much of the basin's revenue is derived from the accommodation of the large number of summer residents in the area as well as from vacationers and sportsmen. There are over 80 privately operated camps in the basin. Most of these camps are for children although there are a few for families and adults. The excellent hunting and fishing opportunities attract a large number of sportsmen during the legal hunting and fishing seasons. With the increase in winter sports activities, a year-round tourist and vacation business has been created for several communities. The three principal skiing areas are the Cumberland and Gorham sections in the lower part of the basin, and the Harrison area in the upper portion. Sebago Lake State Park, located on the northern shore of the lake, receives the heaviest visitor use of all the state parks in Maine, although it is only the fourth largest. This park contains 1296 acres and has facilities for camping, picnicking, hiking, boating and swimming.

6. Transportation. - The centers of population in the basin are served by a network of highways and secondary roads. Route U. S. 1 crosses the mouth of the river between Portland and Falmouth; U. S. 202 crosses the lower part of the basin in a general north-south direction, passing through Gray, Windham and Gorham; and U. S. 302, with one terminus at Portland, runs northwestward through the center of the basin to Bridgton and then turns westward into the Saco River Basin. Bus transportation is available throughout much of the basin. Greyhound Bus Lines operate out of Portland and the Maine Central Bus Lines schedule runs between communities within the basin.

7. The main north-south lines of the Maine Central Railroad and the Grand Trunk System of the Canadian National Railways, passing through Portland, cross the lower end of the basin. The Maine Central Railroad's Mountain Division between Portland, Maine and St. Johnsbury, Vermont, follows the river from Westbrook to above South Windham and then turns to the northwest through the village of Sebago Lake and westward out of the basin. The Boston and Maine Railroad maintains a branch freight service line between Portland and Westbrook. At Westbrook connection is made with tracks of the Sanford and Eastern Railroad Corporation, which runs through Gorham and Buxton to points lying to the southwest of the basin. Northeast Airlines provides regularly scheduled passenger and freight service to major population centers from Portland airport, which is located just outside the basin.

### SECTION III - STORAGE AND STREAM FLOW REGULATION

1. Existing storage. - The total useful storage in the Presumpscot River Basin at the present time amounts to about 285,500 acre-feet (12.434 billion cubic feet) of which 222,700 acre-feet are in Sebago Lake. The balance of 62,800 acre-feet are in lakes and ponds on streams tributary to Sebago Lake. Data on existing storage developments within the basin, based on information furnished by the S. D. Warren Co., are shown in Table 6.

Table 6 - Available storage  
Presumpscot River Basin

<u>Reservoir</u>	<u>Drainage Area</u> <u>(Sq. mi.)</u>	<u>Draw-down</u> <u>(Ft.)</u>	<u>Useful Storage Capacity</u> <u>(acre-feet)(Thous. cu. ft.)</u>	
Crystal Lake	8	8.00	3,740	162,808
Highland Lake	20	7.87	10,580	460,749
Long Lake and Bay of Naples (1)	116	5.34	29,940	1,304,108
Pleasant Lake and Parker Pond	10	5.00	6,140	267,635
Thomas Pond	5	6.80	3,090	134,599
Crescent Lake and Panther Pond (2)	29	4.21	9,300	404,918
Sebago Lake	436	7.63	<u>222,670</u>	<u>9,699,675</u>
Basin Total			285,460	12,434,492

(1) Also known as Brandy Pond.

(2) Also known as Rattlesnake Pond.

2. Operation and regulation. - Storage in the Presumpscot River Basin is operated by the S. D. Warren Co., paper manufacturers and owners of five of the nine plants on the Presumpscot River below Sebago Lake. This company operates the storage mainly to improve flows at its Cumberland Plant located about nine miles above the mouth of the river. A flow of about 30 c.f.s. is diverted from Sebago Lake by the Portland Water District for water supply purposes. The shores of the lakes and ponds in the present storage system are highly developed as summer resorts and recreation areas and drawdown of the water level at various seasons of the year is subject to legal restrictions.

## SECTION IV - WATER SUPPLY

1. This section includes inventories of the quantity and quality of surface and ground waters, an inventory of present water supply uses, and estimates of future water supply requirements. Polluted surface waters and lack of ground water information are creating problems. An additional problem may be created if there is a substantial increase in the use of water for supplemental irrigation.

### SURFACE WATER AVAILABLE

2. Safe yields. - Minimum monthly flows for the period from October 1929 to September 1949 were determined from stream gaging records of the U. S. Geological Survey and used as the safe water supply yield of the various streams. Safe yields could be increased in most basins by constructing storage reservoirs.

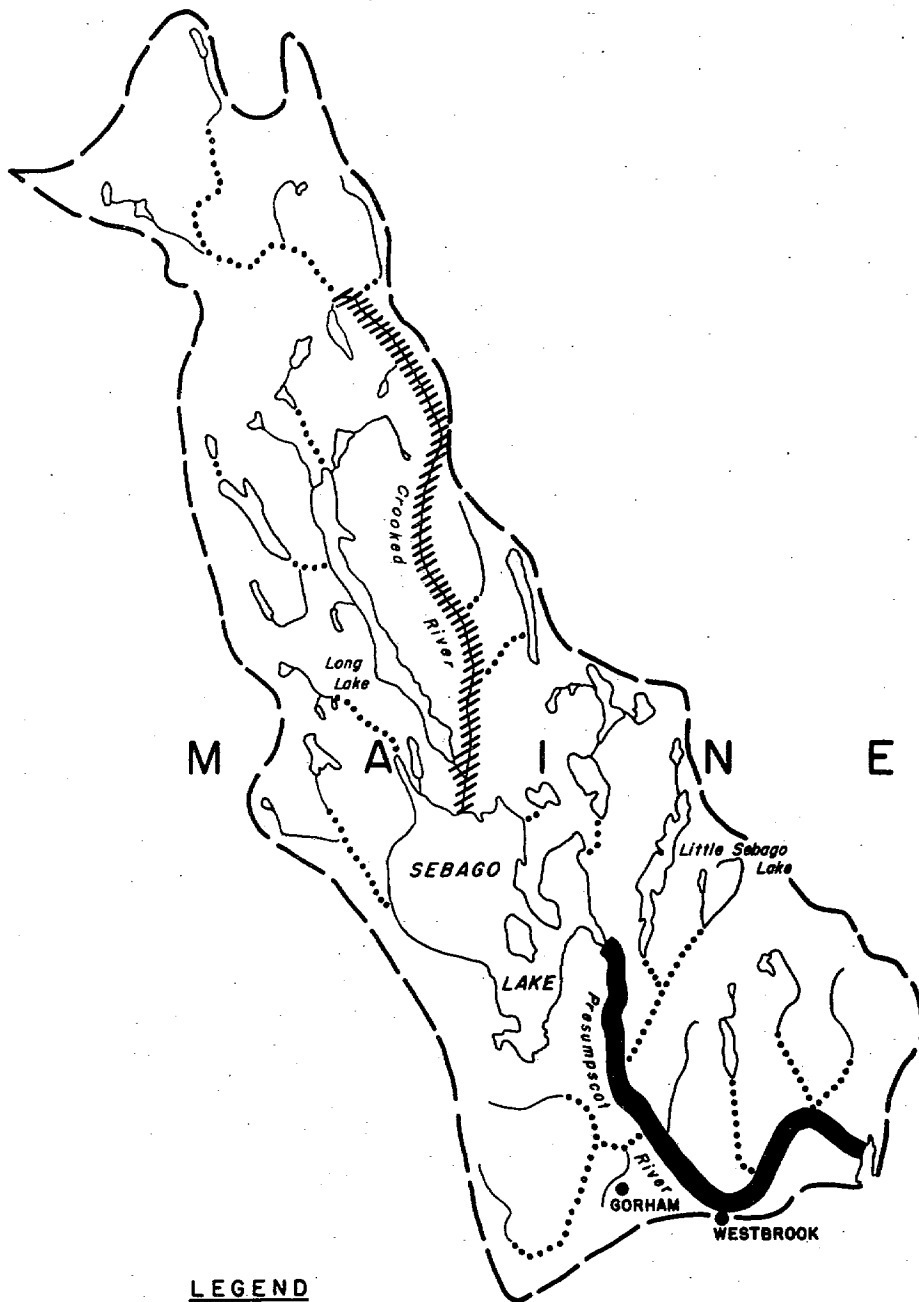
3. The minimum monthly flow or safe yield of the Presumpscot River at Presumpscot Falls, Maine, is 268 million gallons per day (415 cubic feet per second) or 0.437 million gallons per day per square mile. This minimum flow occurred during January 1942. The minimum flow per square mile is very high reflecting the large storage already available in this basin. Minimum monthly stream flows for the Presumpscot River Basin are shown on Plate 2, "Surface Water Supply." Stream flows are taken from gaging stations, where available, and were estimated for other areas by comparison with gaged areas.

4. The Presumpscot River Basin includes 116 miles of streams having safe yields in excess of one million gallons per day, as indicated below and as shown on the map of "Surface Water Supply."

<u>Safe yield in million gallons per day</u>	<u>Miles of streams in Presumpscot River Basin</u>
Over 100	21
10 - 100	30
1 - 10	65
Total over 1	116

5. There are many miles of streams having significant yields of less than one million gallons per day. In addition to the streams, large water supplies could be taken from the lakes of the region.

6. Uncontaminated quality. - The uncontaminated surface waters of the Presumpscot River Basin are soft, relatively low in suspended material and mineral content, and generally suitable for domestic, agricultural and industrial uses although some of the waters in the lower portion of the basin may require treatment prior to use. Table 7 gives the chemical characteristics of the untreated water of three public water supplies obtained from surface sources. The hardness of these three supplies is 15, 15 and 18 parts per million.



# **LEGEND**

—————	Under 1 mgd
.....	1 to 10 mgd
////////	10 to 100 mgd
■■■■■■	Over 100 mgd

## **NOTE**

Surface water supply based on minimum month of record from October 1929 to September 1949.

**PRESUMPCOT RIVER BASIN  
SURFACE WATER SUPPLY**  
NEW ENGLAND NEW YORK INTER-AGENCY COMMITTEE  
JUNE 1953

SCALE IN MILES  
0 4 8

Table 7 - Chemical and physical characteristics of untreated water supplies  
in the Presumpscot River Basin  
June 1953

	SURFACE WATER					GROUND WATER				
	Highland	Crystal	Sebago	Cumberland		North	North			
	Lake ppm	Lake ppm	Lake ppm	Center ppm	Gray ppm	Bridgeton ppm	Windham ppm	Standish ppm	Casco ppm	Otisfield ppm
Color	25	25	10	0	0	0	10	10	0	0
pH <u>1/</u>	6.7	6.8	6.7	6.9	7.1	7.1	6.7	6.7	6.6	7.1
Specific Conductance <u>2/</u>	-	-	-	-	-	-	-	-	-	-
Silica (SiO <sub>2</sub> )	-	-	-	-	-	-	-	-	-	-
Turbidity	0	0	0	0	0	0	0	0	0	0
Iron (Fe)	0.203	0.075	Trace	0.24	0.337	Trace	Trace	0.02	-	-
Calcium (Ca)	2.71	2.50	3.15	9.80	11.70	4.16	2.57	-	-	-
Magnesium (Mg)	0.478	0.510	0.620	1.800	2.400	0.600	0.480	-	-	-
Sodium (Na)	-	-	-	-	-	-	-	-	-	-
Potassium (K)	-	-	-	-	-	-	-	-	-	-
Carbonate (CO <sub>3</sub> )	-	-	-	-	-	-	-	-	-	-
Bicarbonate (HCO <sub>3</sub> )	-	-	-	-	-	-	-	-	-	-
Sulfate (SO <sub>4</sub> )	5.45	4.65	3.94	11.60	7.84	8.80	2.85	-	-	-
Chloride (Cl)	1	5	1	4	6	1	2	2	1	9
Fluoride (F)	0	0.15	0.15	0	0	Trace	0.15	-	-	-
Nitrate Nitrogen	0.02	0.02	0.1	5.0	2.5	0.3	0.5	0.08	0.01	0.6
Total Solids	16	27	21	64	105	39	50	25	-	-
Hardness as CaCO <sub>3</sub>	15	18	15	33	39	25	30	21	29	36
Alkalinity as CaCO <sub>3</sub>	6	7	7	24	27	17	25	-	-	-

1/ No units.

2/ Micromhos at 25° C.

7. The average air temperatures at Portland, Maine, and the average Presumpscot River water temperatures at Westbrook, Maine 1/, for the year 1919 are shown in Plate 3. For about half of the one year period, the average weekly river water temperature was less than the ground water temperature of 43.5° F which indicates the utility of the river water for cooling purposes.

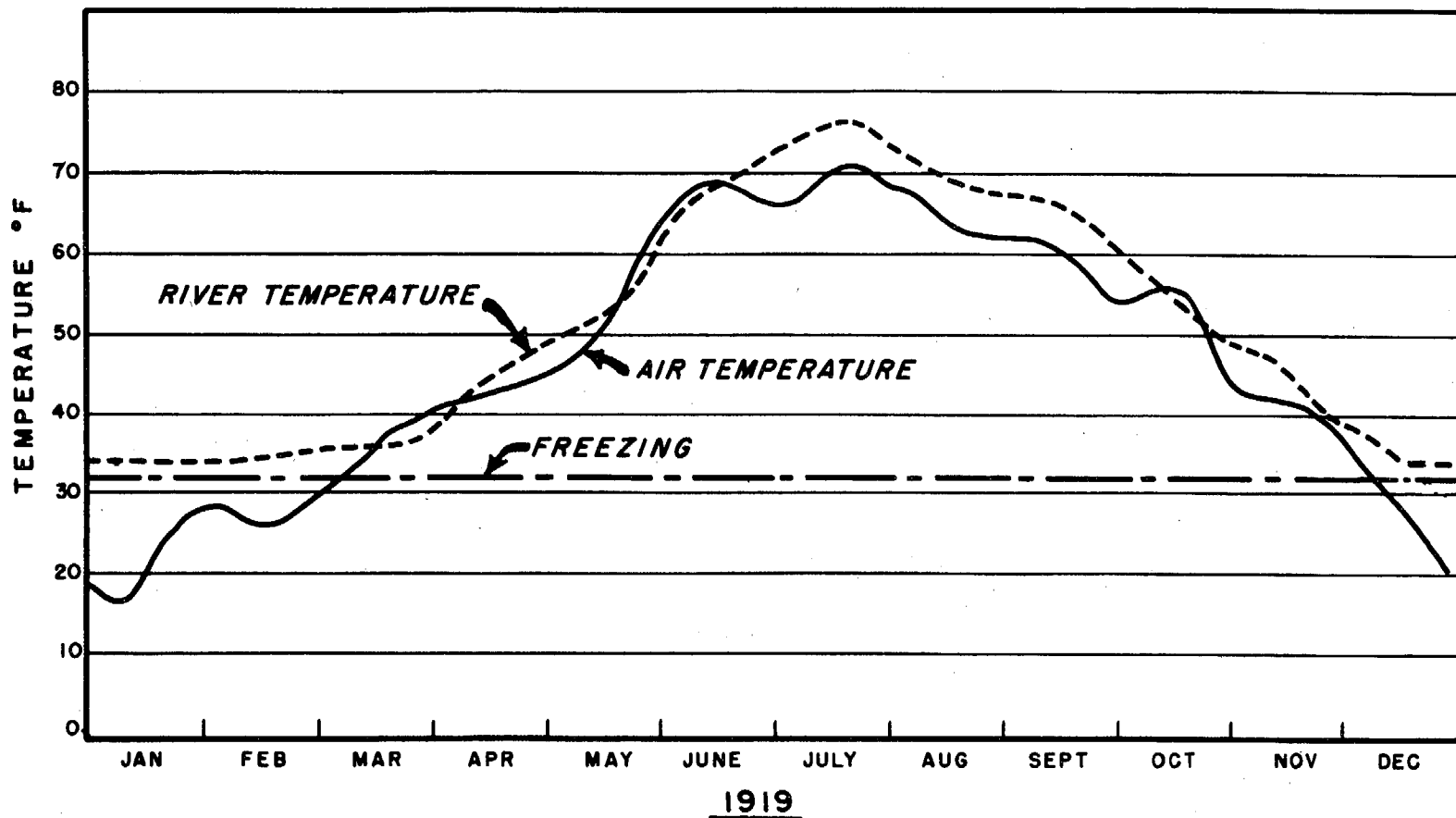
8. The data available on the mineral and physical quality of waters of the principal streams of the Presumpscot River Basin are generally adequate to properly define the industrial utility of the water. These data may be obtained from the Division of Sanitary Engineering of the Maine Department of Public Health and Welfare, and the Quality of Water Branch of the U. S. Geological Survey. These agencies have continuing programs to supplement information now available.

9. Sanitary quality. - The sanitary quality of the surface water is shown on Plate 8, "Approximate Present Stream Conditions," and is summarized on Table 8, "Summary of known present effects of industrial and municipal pollution on fresh stream water quality in the Presumpscot River Basin." The Condition I water is scattered throughout the basin. The two miles of Condition IV water are in Tannery Brook in Gorham. The eight miles of Condition V water are in the Presumpscot River downstream of Westbrook.

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1/ Air temperatures from U. S. Weather Bureau Station at Portland, Maine. The Presumpscot River temperatures courtesy of the S. D. Warren Company at Westbrook.

PRESUMPCOT RIVER BASIN  
AVERAGE WEEKLY AIR AND  
RIVER TEMPERATURES  
NEW ENGLAND NEW YORK INTER-AGENCY COMMITTEE  
JUNE 1953  
SCALE AS SHOWN



**NOTE:**

*Air temperatures from U. S. Weather Bureau Station  
at Portland Maine.*

*Presumpscot River temperature from S.D. Warren Co.  
at Westbrook Maine.*

Table 8 - Summary of known present effects of industrial and municipal pollution  
on fresh stream water quality in the Presumpscot River Basin  
June 1953

IV-5

Condition	Suitable for Water Supply Uses	Degree of Pollution	Miles of Streams Having One MGD or More of "Safe Yield"
I	Suitable for all water supply uses. Use for domestic water supply may require disinfection.	None	93
II	Suitable for public water supply after filtration and disinfection for most industrial uses*without treatment, for agricultural use and for irrigation of crops.	Not appreciable	nil
III	Suitable for many industrial water uses*without treatment and for irrigation of crops consumed after cooking.	<i>Moderate</i> <del>Slight</del>	13
IV	Suitable for some industrial water uses*without treatment.	Severe	2
V	Suitable for no water supply uses	Gross	8

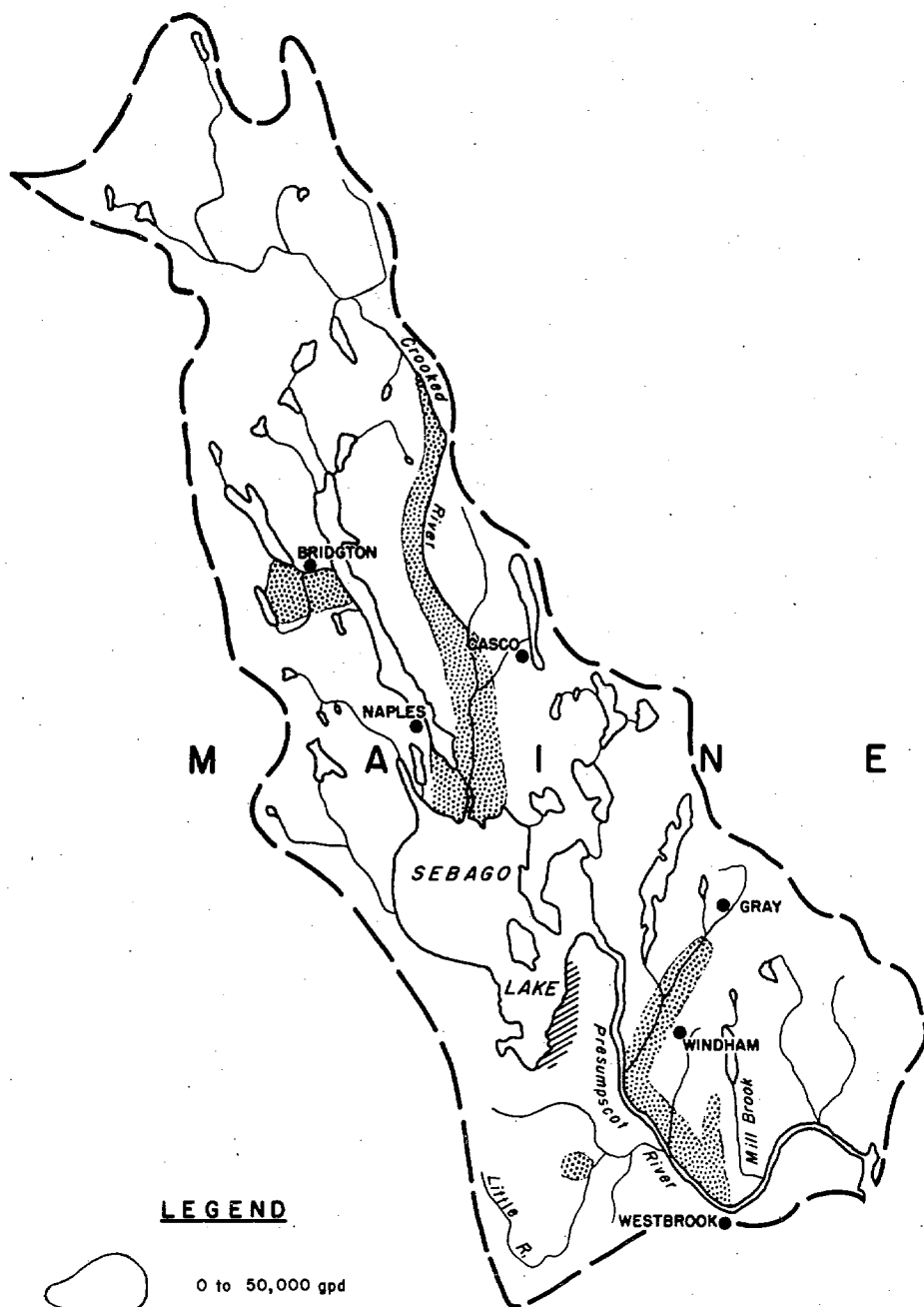
\* Quality requirements for industrial water vary widely. Condition I water may require treatment for some industrial uses. Condition IV water is used without treatment for some industries requiring low quality water. As water condition decreases from I to IV, it becomes suitable for fewer industrial uses or becomes more difficult to make suitable by treatment.

## GROUND WATER AVAILABLE

10. A reconnaissance study of the ground water resources of the Presumpscot River Basin was made by the Ground Water Branch of the U. S. Geological Survey. From the interpretation of the geologic maps of this basin and field investigations, areas of significant ground water yield were determined and are shown on Plate 4. Ground water adequate to meet the needs of individual rural homes and farmsteads for domestic water, stock watering and spraying is available from bed rock or glacial sediments throughout the basin. Of these, the glacial deposits are by far the better source. Since the most dependable and least expensive methods for developing ground water are unknown in most areas, supplies which are developed frequently prove inadequate.

11. Yields from bedrock. - Most of the wells now being drilled in the Presumpscot Basin are for domestic water supplies. The hard crystalline bedrock of the basin has little or no porosity and is highly impervious except where fractures and jointing systems occur. Yields from bedrock are dependent upon the presence of these fissures. No average figure for depth of wells or production in gallons per minute (gpm) have been obtained but most wells penetrate to depths of from 50 to 200 feet and produce from one to ten gpm, a quantity sufficient for domestic or limited farm use.

12. Yields from unconsolidated deposits. - Relatively shallow dug wells in till are common on upland farms and residences, but in recent years many of these wells have failed during dry periods. Most wells in till probably produce less than 10 gpm.



# **LEGEND**



0 to 50,000 gpd



50,000 to 1,000,000 gpd



Over 1,000,000 gpd

PRESUMPCOT RIVER BASIN  
 EXPECTED YIELD OF WELLS  
 NEW ENGLAND NEW YORK INTER-AGENCY COMMITTEE  
 JUNE 1953

SCALE IN MILES  
 0 4 8

13. Outwash deposits offer the best ground water sources in this basin, but, because of the lack of exploration, a high level of production has not been realized. Exploration is especially desirable since there is a high percentage of clay and silt, which inhibit production, in areas containing the most extensive deposits. In some cases, relatively impermeable strata of silt or clay create an artesian condition by confining the water in underlying aquifers of sand or gravel. There are several persistent springs in the basin.

14. Quality.-- Plate 5, "Ground Water Hardness," shows the natural hardness of the several ground water supplies in the Presumpscot River Basin. Table <sup>7</sup> 1, "Chemical and Physical Characteristics of Water Supplies in the Presumpscot River Basin," gives the values of the physical and chemical characteristics of the untreated water for seven ground water supplies.

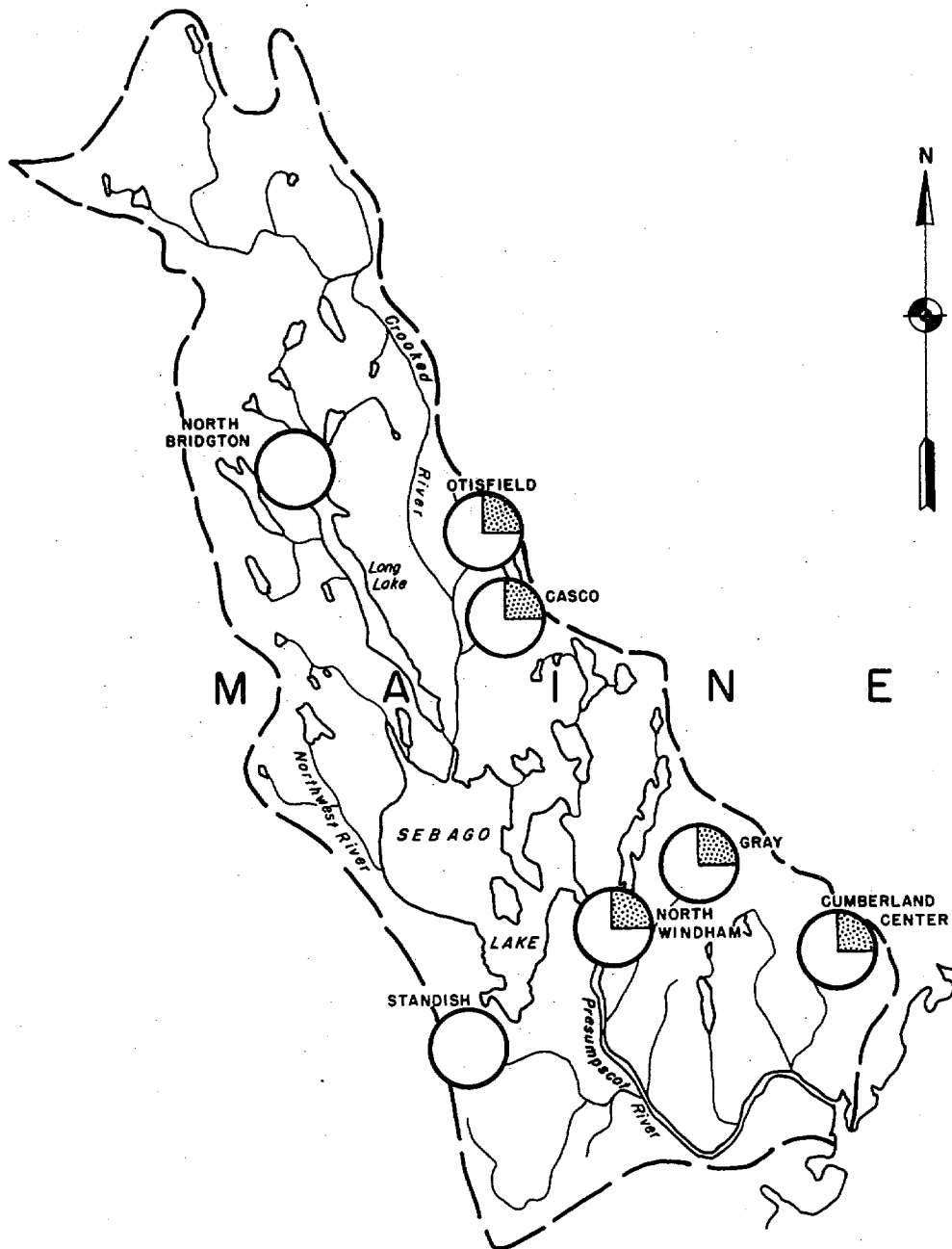
15. The sanitary quality of ground waters in their natural condition is excellent, but ground water from private wells located in and around heavily-populated areas of the basin is often not safe as a source of domestic water supply. Shallow wells to be used for domestic purposes in and around heavily-settled areas should be eyed with suspicion.

## WATER USE

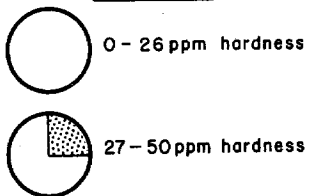
16. Water uses considered are, domestic, industrial and agricultural. "Domestic" includes water used by commercial establishments such as stores, hotels, restaurants and markets, as well as water used for bathing, cooking, washing, cleaning and other household purposes. "Industrial" includes process water, cooking water and boiler feed along with other miscellaneous industrial water uses. "Agricultural" water is used for stock watering, irrigation and other miscellaneous agricultural water uses.

17. Rural and agricultural. - Rural domestic water supplies and agricultural water supplies depend on many small sources. In general, they have little effect on the available water supply, are not affected by other water supply requirements, and are important in the basin water supply picture only when a significant amount of water is used for irrigation.

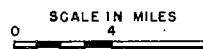
18. The private rural water systems supplying domestic and agricultural water serve 17,700 persons, including an unknown number of farms. These systems number approximately 4,425 and supply approximately 1.3 million gallons per day of ground water for all rural water use except irrigation. Each system supplies 300 gallons per day on the average. An agriculture survey indicated that approximately 2345 (53%) of the rural systems were inadequate for domestic water supply in this basin. In addition



# **LEGEND**



## **PRESUMPCOT RIVER BASIN GROUND WATER HARDNESS** NEW ENGLAND NEW YORK INTER-AGENCY COMMITTEE JUNE 1953



to the rural water supplies which are inadequate for domestic water supplies, some are inadequate for livestock watering and for spraying.

19. The amount of water used for irrigation in this basin is unknown. Estimates made from the Department of Agriculture survey which covered the St. Croix River, the Saco River, the Presumpscot River and the Maine Coastal Area indicated that this water use is not significant at the present time. Irrigation is a consumptive use of water. Present irrigation practices probably result in all of the irrigation water being lost to other water uses by evapo-transpiration. The number of farms now wishing to irrigate and unable to secure water for that purpose is unknown but probably small.

20. Municipal and industrial.- Of the 25.4 million gallons per day of fresh water used by all industrial and municipal water systems in this basin, industry uses a total of 23.1 million gallons per day. Eleven public water systems supply 2.9 million gallons per day, of which 2.3 is for domestic use by 16,700 persons and 0.6 is for industrial use. Industries supply 22.5 million gallons per day for their own use.

21. The 25.4 million gallons of water per day used in this basin are mostly supplied by Sebago Lake and the Presumpscot River. This includes a slight amount of water that is reused as the result of communities and industries located on the upper reaches

of the streams returning used water to the streams which drain to Sebago Lake. The water is utilized downstream by other users.

22. Plate 6, "Total Daily Water Use," gives an indication of the distribution of total daily water use in million gallons per day throughout the basin. Significant amounts of water are used in a number of towns and cities, most of which are supplied by municipal water systems. About 98 percent of the total amount of water used in this basin is utilized in the Portland Water District which serves Gorham, South Windham, Standish, Westbrook and Windham. A total of 24.9 million gallons per day is used here for both domestic and industrial purposes.

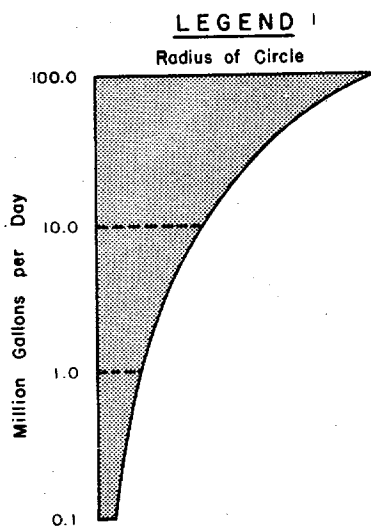
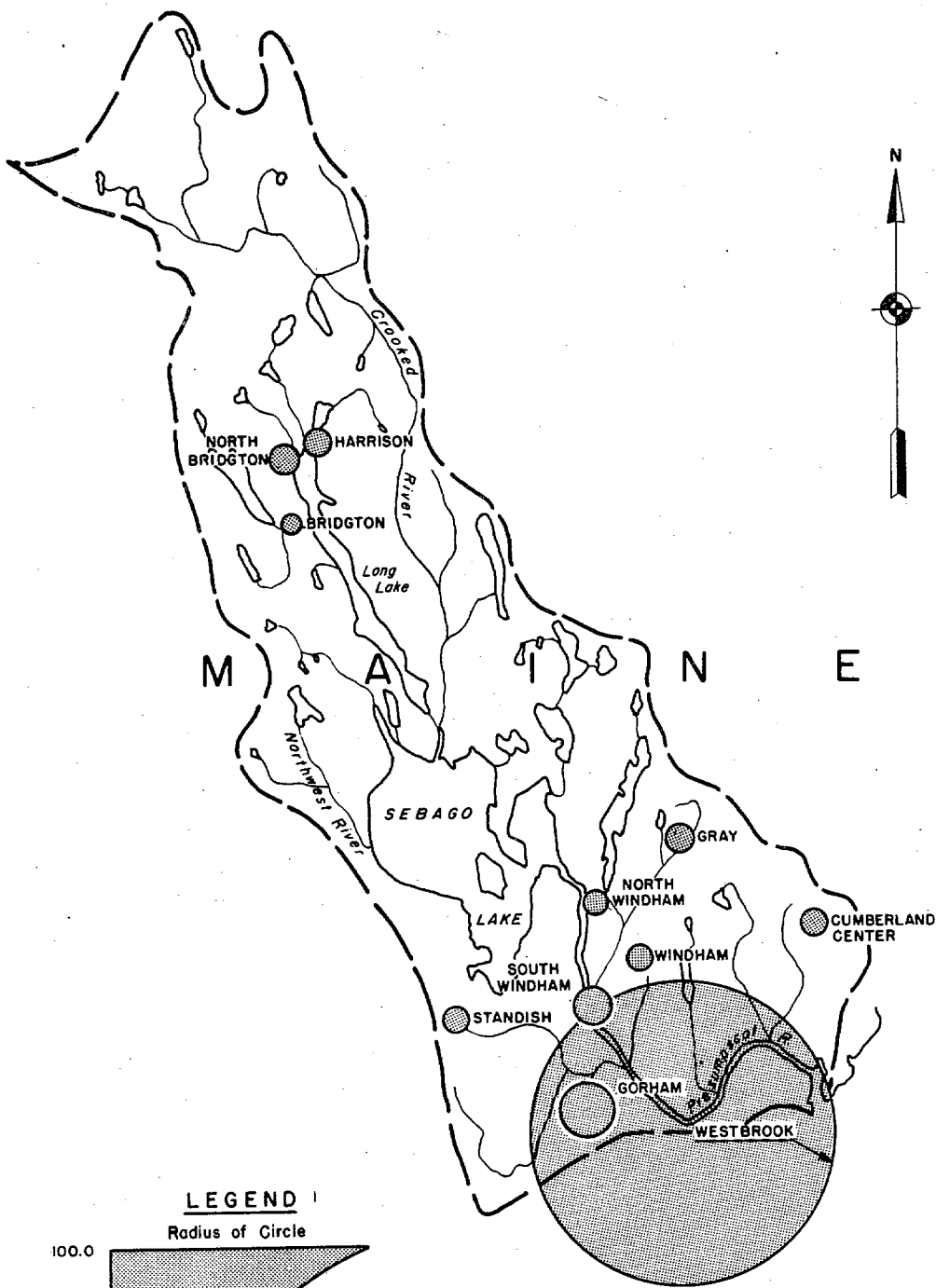
23. Industrial water use.- Total industrial fresh water use in the basin is divided as follows:

- a. Cooling water, 1.3 million gallons per day (5.6%)
- b. Process water, 20.5 million gallons per day (88.8%)
- c. Boiler feed, sanitary, service, etc., 1.3 million gallons per day (5.6%)

Total 23.1 million gallons per day.

24. Industrial fresh water use may also be divided by type of products as follows:

- a. Pulp, fibre and paper mills, 22.4 million gallons per day (97.0% )
- b. Textile mills, 0.1 million gallons per day (0.4%)
- c. Miscellaneous, 0.6 million gallons per day (2.6%)



PRESUMPCOT RIVER BASIN  
 TOTAL DAILY WATER USE  
 NEW ENGLAND NEW YORK INTER-AGENCY COMMITTEE  
 JUNE 1953  
 SCALE IN MILES

A scale bar showing distances in miles, with markings at 0, 4, and 8 miles.

25. Surface water use. - Of the 25.4 million gallons per day total water used in the basin, 24.6 million gallons per day come from surface sources. The seven public systems which obtain water from these surface sources supply a total of 2.5 million gallons per day. The remaining 22.1 million gallons per day of surface water are supplied and utilized by industry. Of approximately 22 mgd of water obtained from Sebago Lake by the Portland Water District, about 2.4 mgd is used in this basin. The remaining 19.6 mgd is transported by closed conduits to the consumer, mostly in Portland, and is not available for any use in between. After use, the water is discharged to the sea. This situation results in a single water use between the source and the sea. Conversely, the water used by industry located along the Presumpscot River is available for reuse shortly after being used and discharged with, of course, the provision that the quality is satisfactory.

26. Ground water use. - There are 0.8 million gallons per day of ground water used in the basin. Three public water systems utilize 0.4 million gallons per day and industry supplies itself the remaining 0.4 million gallons per day. One public water supply obtains its water from both surface and ground sources. This community's water consumption is divided between the ground and surface water figures.

27. Reuse. - Industrial and domestic water is used, not consumed and becomes available to other water users immediately after a given industry or municipality has discharged it. Even

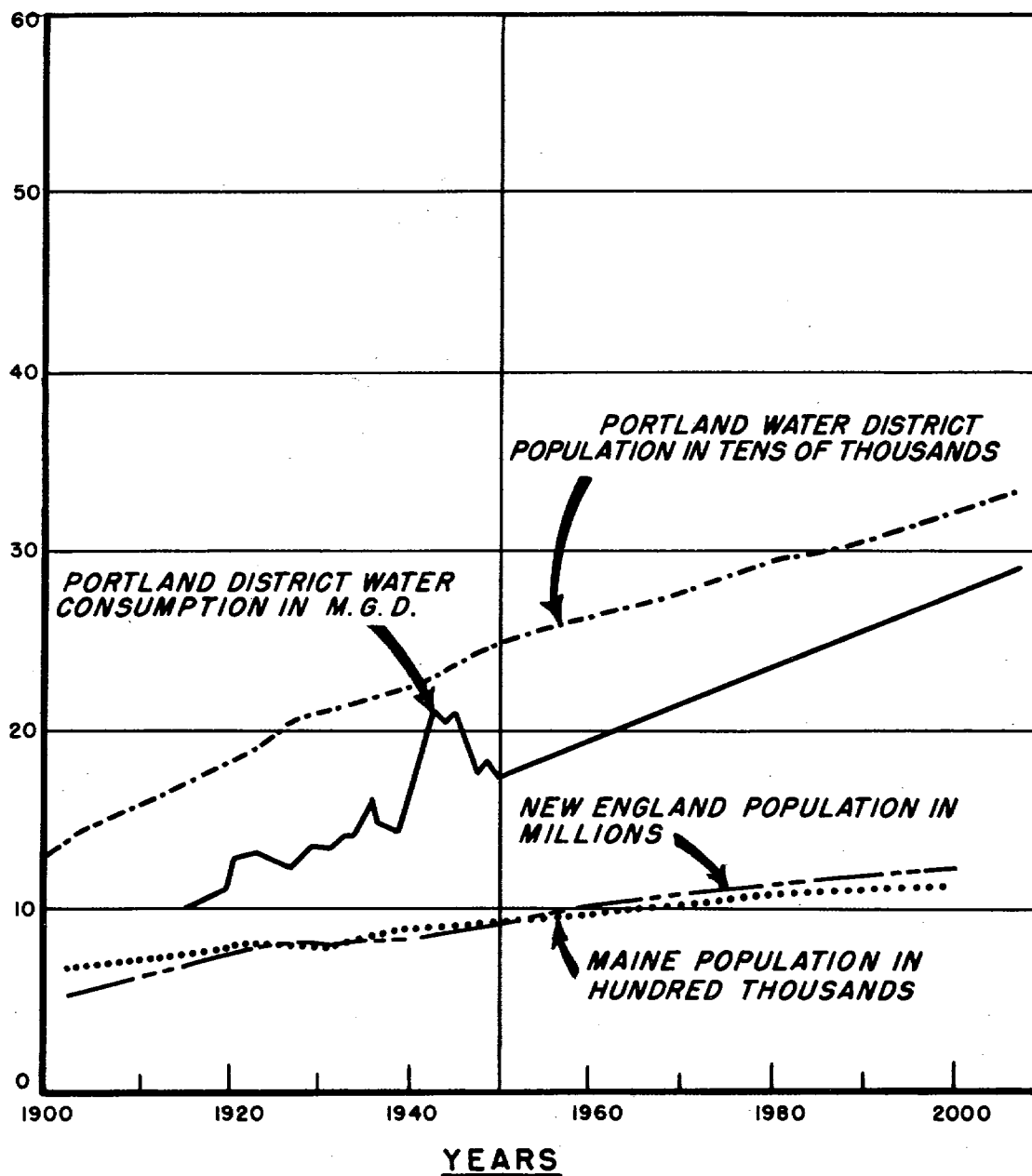
when the entire flow of a stream is taken for a water supply, it is usually returned to the stream within a short distance. It then becomes available for reuse, provided the quality of the water is satisfactory for the intended uses.

28. In this basin, the stream waters are in Condition IV or V below two out of eleven communities from which used domestic or industrial waters are discharged into fresh water. Conditions IV and V waters are "severely" and "grossly" polluted respectively and are unsuitable for domestic and most agricultural and industrial uses.

#### DISCUSSION OF FUTURE WATER RESOURCES

29. Future trends. - Trends in water use give a basis for estimated future water use. The prediction of domestic water use depends on the population to be served. Industrial water use trends are more difficult to predict since technological changes or the addition or loss of one significant water-using industry may markedly change water use even though population and employment do not change. Agricultural water use may increase markedly if irrigation becomes widely practiced.

30. The trend in municipal water supply of the Portland Water District is shown on Plate 7. Also given is the trend in population of the area which is served by the Portland Water



# PRESUMPSCOT RIVER BASIN WATER CONSUMPTION AND POPULATION TRENDS

NEW ENGLAND NEW YORK INTER-AGENCY COMMITTEE

JUNE 1953

SCALE AS SHOWN

PLATE NO. 7  
CHAPTER VIII

District. The trends for New England and for Maine populations are also shown. The population trend line indicates that in the year 2000 population may be at least 1.6 times the present.

Assuming that a twofold increase in population will result in a threefold increase in water use, the Presumpscot River Basin area will be using fresh water at the approximate rate of 108 million gallons per day, or an increase of 2.4 times the present use.

31. Even with this increase, there will be a surplus of water available at least to the year 2000. This surplus of water would support new wet industries if transportation, public utilities, labor and other essentials could be provided.

32. A comparison of total water use to water available will indicate the scarcity or abundance of water at the present and in the future. The ratio of total fresh water use to the surface water available at the outlet of Sebago Lake, above Portland is about 1 to 3.5. This ratio downstream at Westbrook is about 1 to 6. As previously mentioned, almost 99 percent of the total water used in this basin is utilized in this area. Therefore, the ratio of total water use to water available in other sections of the basin would be even less than in the Portland Water District area. These comparisons indicate a moderate surplus of water available in the year 2000, even if the total water use increased 2.4 times.

33. Future quality. - The quality of the water in the future will depend on the action taken to maintain or improve the present water condition by control of municipal and industrial pollution and perhaps by improved land use practices to control erosion.

#### CONTROL OF RESERVOIRS FOR PUBLIC WATER SUPPLIES

34. Control of reservoirs exclusively for public water supply purposes is not practiced in this basin with the exception of a restricted area near the Portland Water District intake from Sebago Lake. The remainder of Sebago Lake, as well as Highland Lake and Crystal Lake, are unrestricted for fishing, swimming and boating purposes. This partial control of Sebago Lake does not significantly interfere with other water uses.

#### CONCLUSIONS

35. It is concluded that:

- a. A great surplus of water will be available for water supply in this basin for at least the next 50 years on the basis of needs now foreseeable. Most of this surplus will probably be surface water.
- b. The surplus of water is a valuable natural resource and could be attractive to new industries having large water demands.
- c. The Portland Water District takes 22.0 mgd from Sebago Lake. Approximately 2.4 mgd are used in this basin. 19.6 mgd are used in Portland and surrounding communities which are located in the Maine Coastal Area.

d. The natural surface waters of this basin are very soft, have a low mineral content and are slightly acid. They are suitable for all general water supply uses.

e. The present quality of ten miles of streams impaired for most water supply uses by discharges of sewage and industrial wastes, and 13 miles are impaired for some water uses. There are 93 miles of streams that are essentially unaffected.

f. The practice of using reservoirs for public water supplies to the exclusion of some other uses is not widespread in this basin and causes no significant interference with other water uses.

g. Data for the quality of waters in this basin are adequate to define the general usefulness of the untreated water for industrial uses.

h. Ground water is generally available throughout the basin in small quantities which can be developed to meet the needs of individual rural homes and farms for domestic and agricultural use, except irrigation. Moderate quantities can be developed in some areas in the southern and central part of the basin. Large quantities can be developed in one area along the south shore of Sebago Lake.

i. The ground waters of the basin have a low hardness and mineral content and, except for excessive iron in some areas, are chemically suitable for nearly all water supply uses as taken.

j. A sharp increase in agricultural water use for supplemental irrigation could significantly reduce the water available in small watersheds, especially during dry hot weather and would require consideration of the legal basis for its use.

k. Approximately 53 percent of the 4,428 ground water supplies developed by rural families (17,700 inhabitants) are not adequate to meet the demands for domestic and agricultural water, with no allowance for irrigation.

l. The domestic water supply requirements of rural families have little effect on the available water supply in the basin, and in general, are not affected by other water supply demands.

#### WATER SUPPLY PLAN

36. The Water Supply Plan is as follows:

a. Improvement of water quality. - Pollution control measures described in Section V would improve the quality of deteriorated stream water. These improvements include making the water attractive to industry where increased industrial use is desirable. Major consideration would need to be given to the water supply needs of industry in the formulation of a comprehensive pollution control plan for future best water use.

b. Investigation of supplemental irrigation. - A study of supplemental irrigation should be made to determine when water used for irrigation purposes has increased so as to threaten to affect

other water uses. The study would include the annual collection of data on the acreage irrigated, the amount of water used, the sources of water and the types of crops irrigated. Assuming collection of data by existing agricultural field staffs and organizations, it is estimated that the services of one man, part-time, would be required to analyze data and coordinate field activities. The estimated annual cost of the investigations is approximately \$500.

c. Ground water investigations. - To determine the ground water potential of the Presumpscot River Basin, the following studies on the ground water should be made.

<u>Location</u>	<u>Approximate area in square miles</u>	<u>Type of study</u>
Environs of Sebago Lake	193 -----	Reconnaissance
Rural and suburban areas	238 -----	Intermediate
Norway area	217 -----	Comprehensive
	<u>648</u>	

(1) A reconnaissance study would entail the collection of a limited amount of data on springs, wells, and major water supplies. This type of study would also include the collection of a limited number of samples for chemical analyses and a very general geologic mapping program.

(2) An intermediate study would involve a fairly thorough inventory of data on springs and wells, their chemical characteristics and collection of samples for chemical analyses.

In addition, it would include sufficient geologic investigations and mapping to define the principal water bearing units, their areal extent, thickness and water bearing characteristics.

(3) A comprehensive study would include mapping the surficial and bedrock geology of the area as needed to delineate the areal extent of the water bearing formations. In addition, the collection and evaluation of sub-surface data such as records of wells, test borings, springs, their logs and yields and chemical analyses of water samples would aid in determining the thickness of the aquifers, their potential yield and the quality of the water. This type of study would outline source areas favorable for the development of both large and small water supplies. It would also serve as a basis for the development of dependable ground water supplies at a minimum of cost by rural residents and farmers.

A preliminary estimate of the cost of the studies needed to properly evaluate the availability of ground water for public supply, industry and domestic use is \$20,000. The work involved would require about two man years, which includes field work and the preparation of but not the publication of one report for the entire basin.

**Table 9 - Water use and water supplied, Presumpscot River Basin**  
June 1953

Name	Water Used			Municipal Water Supply						Private Industrial Water Supply		
	Total	Domestic	Industrial	Source	Treatment	Population Served	Total	Domestic Uses	Industrial Uses	Total	Surface Sources	Ground Sources
	MGD	%	%				MGD	%	%	MGD	%	%
<u>Presumpscot River</u>												
Bridgton	0.120	83.3	16.7	Surface	Dc Ng	2,100	0.110	90.9	9.1	0.010	100.0	0.0
Cumberland Center	0.030	100.0	0.0	Ground		300	0.030	100.0	0.0	0.0	-	-
Gorham <u>1/</u>	0.513	64.0	36.0			2,200	0.330	100.0	0.0	0.183	0.0	100.0
Gray	0.108	100.0	0.0	Ground	Dh	1,100	*0.108	100.0	0.0	0.0	-	-
Harrison	0.012	100.0	0.0	Surface	Dh	250	0.012	100.0	0.0	0.0	-	-
North Bridgton	0.260	100.0	0.0	Ground	None	260	0.260	100.0	0.0	0.0	-	-
North Windham	0.029	100.0	0.0	Surface	Dh	500	0.029	100.0	0.0	0.0	-	-
				Ground								
Portland W.D. <u>2/</u>				Surface	Ng Dc							
South Windham <u>1/</u>	0.236	38.1	61.9			600	0.236	38.1	61.9	0.0	-	-
Standish <u>1/</u>	0.075	100.0	0.0			500	0.075	100.0	0.0	0.0	-	-
Westbrook <u>1/</u>	23.912	5.0	95.0			8,000	1.586	75.7	24.3	22.326	98.9	1.1
Windham <u>1/</u>	0.137	100.0	0.0			910	0.137	100.0	0.0	0.0	-	-
						<u>3/</u>						

\*Rated plant capacity.

1/From Portland Water District.

2/Portland is partly in this basin.

3/Winter population.

Dc - Disinfection with chlorine gas.

Dh - Disinfection with hypochlorite.

Ng - Ammoniation with ammonia gas.

## SECTION V - POLLUTION CONTROL

1. This section presents an inventory of pollution contributed to the water resources, the effects of pollution on present water conditions, pollution prevention measures in effect, and stream classifications legally adopted for best use of the water resources. In lieu of legal classification of streams transporting pollution which would define the pollution control measures needed to permit the best use of the water resources, three provisional plans are presented. Each provisional plan is evaluated as to its effect on water quality improvement for higher uses and the costs and benefits to pollution control under the treatment measures shown, including an evaluation of monetary benefits or losses as a result of constructing water conservation and development projects.

### POLLUTION CONTRIBUTED TO WATER RESOURCES

2. Since the upper basin is relatively undeveloped, the significant pollution has been confined to the lower one-fifth of the area, below Windham on the main stem, and in the town of Gorham on the Little River system. An exception is Stevens Brook in Bridgton.

3. Sewage and industrial waste pollution. - Of the total of 15 separate sources of pollution, 11 result from the discharge of sewage from municipalities, institutions, and other population centers and factories that have a total contributory population

reported to be <sup>11,715</sup>~~11,795~~ persons. Four sources of pollution originate from organic industrial wastes, and are caused by one plant engaged in processing foods and kindred products, two plants discharging textile mill wastes and one discharging wastes from the manufacturing of sulfate pulp and paper. The combined population equivalent of industrial wastes has been computed to be about 108,000 when all plants are operating at or near capacities. Tables 10-11 summarize these data, and more detailed information on individual sources of pollution is given in Table 25.

4. Other pollution factors. - Although soil erosion from row cropland and stream bank erosion have been reported as in need of correction, erosion has not been reported as a factor in water pollution affecting water qualities for use. Neither has the use of agricultural fertilizers or insecticides been reported as significant to stream pollution.

Table 10 - Sources of pollution -- municipal,  
Presumpscot River Basin

Municipalities <u>1/</u>	Sources (In Number of Municipalities) <u>1/</u>	Population Served by Sewerage System	Pollution Discharged (In Terms of Popula- tion Equivalent) <u>2/</u>
Having data on pollution load discharged to watercourse	11 <u>3/</u>	11,715	11,525
Having population data available <u>4/</u>	0	0	Undetermined
TOTAL	11	11,715	xxxxx

- 1/ Includes incorporated or unincorporated municipalities; other legal bodies as sanitary districts, counties, towns; significant institutions, resorts, recreational centers or other population centers; and industries discharging sanitary sewage only directly to watercourse.
- 2/ Includes industrial wastes discharged into municipal sewerage systems.
- 3/ Includes 3 industrial plants having sanitary wastes only from a total of 285 employees.
- 4/ Data on pollution load to watercourse incomplete or not available.

Table 11 - Sources of pollution -- industrial,  
Presumpscot River Basin

Industries <u>1/</u>	Sources of Pollution (In number of Plants)	Amount of Pollution Discharged to Watercourse (In Terms of Equivalent Number of People)
Producing Organic Wastes	4	108,000
Producing Organic Wastes	0	Undetermined
Producing Wastes of Undetermined Type	0	Undetermined
TOTAL	4	xxxxx

- 1/ Industries having separate outlet discharging wastes directly to watercourse.

## EFFECTS OF POLLUTION ON PRESENT WATER QUALITY

5. Effects on main stem of Presumpscot River. - The main stem of the river from Westbrook to Casco Bay is seriously affected by pollution. Over this eight mile stretch, the water quality deteriorates from gross pollution into nuisance conditions during critical periods of low flows and high temperatures, and the water is suitable for no legitimate purpose except power development. Pollution is caused by the municipal sewage from over 10,000 persons in Westbrook and the industrial wastes and/or sanitary sewage from three manufacturing plants, that have a total population equivalent of approximately 100,000 persons. The main stem from South Windham to Westbrook is less seriously affected by the sewage, from about 460 persons, discharged from four separate sources in Windham. Over this six-mile stretch, the water is unsuitable for those purposes that require a high water quality but is satisfactory for a number of other normal water uses.

6. North Branch, Little River. - A cannery in Gorham discharges untreated wastes to the North Branch of the Little River that have a population equivalent computed to be about 8,000 persons. This amount of pollution is sufficient to significantly affect downstream water qualities for about two miles for those water uses that require a high quality. The aesthetic quality of these waters is not always satisfactory.

7. Tannery Brook. - The thickly settled portion of the town of Gorham discharges the untreated sewage from about 200 persons to Tannery Brook, a small tributary of Little River. For about two miles above its confluence with the Little River, the brook is seriously affected by this pollution and is suitable for very limited purposes, principally for transporting the present pollution load without nuisance.

8. Stevens Brook. - Stevens Brook, the outlet stream of Highland Lake, receives sewage pollution from some 200 persons or more in Bridgton village and industrial wastes and employee sewage from a woolen mill in the town. Throughout its two-mile length, the water in the brook is unsuitable for those purposes which require a high water quality and the aesthetic quality is not always satisfactory.

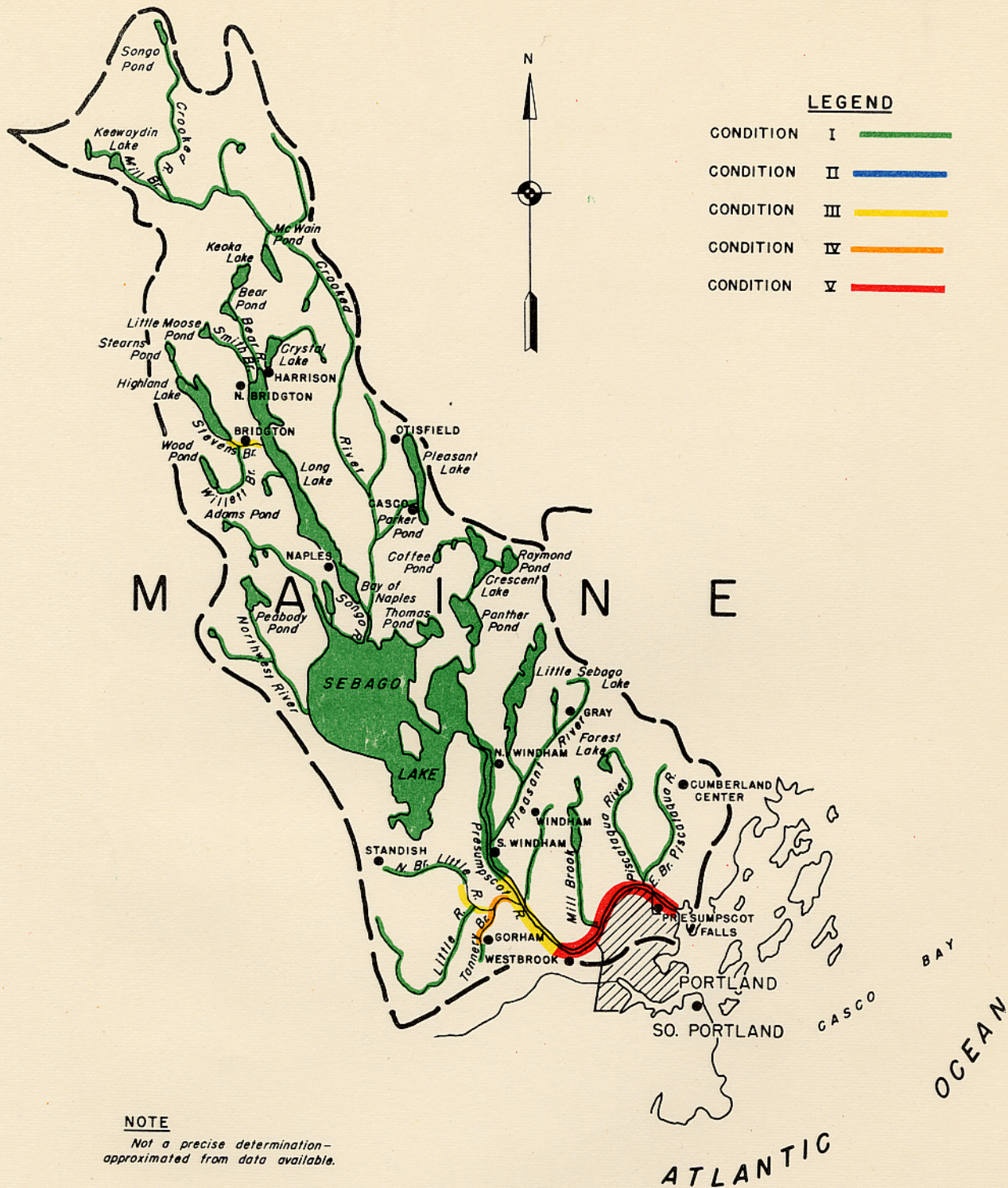
9. Highland Lake, Long Lake and Bay of Naples. - Highland Lake receives sewage pollution from approximately 80 persons in Bridgton, Long Lake from private sewers serving about 100 persons in Naples, and Bay of Naples from private sewers serving some 50 persons in Naples. The effects of these sources of sewage pollution on the water quality of these three lakes is confined to the immediate vicinity of the sewer outlets. The amount of water available for dilution of these sewage discharges is very large and their effect is principally the bacteriological pollution of these important recreation waters.

10. Effects of pollution on shellfish areas. - Pollution transported by the Presumpscot River, together with pollution discharged in the coastal area in the town of Falmouth and by the city of Portland, has caused the closing of all tidal areas of the Presumpscot River and its tributaries to the taking of shellfish.

11. Effects of pollution on agricultural uses. - Five farms in the Presumpscot River Basin have been reported by the U. S. Department of Agriculture as not using the streams for agricultural purposes because of pollution. There are possibly other farms, not reported, that do not use streams for agricultural purposes because of pollution.

12. Water unaffected by pollution. - The great majority of the water resources in the Presumpscot River Basin receive no pollution and are of a uniformly high quality, suitable for all purposes. The basin contains many lakes, both large and small, and many miles of excellent streams. These water resources, of high quality and reasonably near large centers of population, could support a considerable growth in the recreation industry.

13. The general discussion of existing water conditions above is presented more clearly and in more detail in Table 12 and by Plate 8. The table is a summation of present water quality of each of the streams and their tributaries transporting pollution. The name of the watercourse, a summary of pollution contributed, the estimated present water condition, the approximate lengths of



streams affected during periods of low flow (flow exceeded 95 percent of the time), and average conditions of pollution are given. The main stems of streams are indicated by (main stem) and the sub-basins of tributaries are given in parentheses.

14. The miles of watercourse given in Table 12 represent the lengths of streams affected or unaffected by pollution as approximated from the best hydrologic, pollution and analytical data available. There is probably much of the year when effects from pollution are less serious than indicated, just as there are periods of critical low flows and high water temperatures when effects may be more serious than shown. A precise assessment of the effects of pollution on water quality would require detailed, extended investigations to determine the degree of pollution, influence of self-purification forces, present water uses and best future uses.

15. In Table 12 the approximate effects of pollution on condition of waters receiving pollution are indicated as to the suitability of these waters for use. Water conditions are expressed in terms of the tentative water quality standards of the New England Water Pollution Control Commission which have been adopted for this purpose. All of the water uses shown may not be made or contemplated at the present time and their discussion is intended solely to describe the relative effect of existing pollution on present water conditions. Plate 8 shows these data in more graphic form as the approximate status of present stream conditions.

Table 12 - Approximate effects of pollution on present water conditions,  
Presumpscot River Basin, 1953

Key to Symbols

<u>Condition</u>	<u>Suitability for Use</u>
I	Suitable for any water use. Character uniformly excellent.
II	Suitable for bathing and recreation, irrigation and agricultural uses; good fish habitat; good aesthetic value. Acceptable for public water supply with filtration and disinfection.
III	Suitable for recreational boating, irrigation of crops not used for consumption without cooking; habitat for wildlife and common food and game fishes indigenous to the region. Suitable for public water supply if shown acceptable by technical studies.
IV	Suitable for transportation of sewage and industrial wastes without nuisance, and for power, navigation and other industrial uses for which it is acceptable.
V	Unsatisfactory. Waters falling below the above descriptions.

Watercourse	Effects Resulting from Discharge of:	Approximate Effects & Extent in Miles				
		I	II	III	IV	V
Presumpscot River (main stem)	Untreated municipal wastes from 10,500 persons in city of Westbrook. Untreated domestic wastes from 100 persons in South Windham and from 200 persons at the men's reformatory, also untreated sanitary wastes from 285 employees of two machine shops and a textile mill. Untreated industrial wastes from a cotton mill and a pulp and paper mill.	9	0	6	0	8
Little River (main stem)	Pollution transported by two tributaries.	12	0	3	0	0
Tannery Brook (Little River Basin)	Untreated domestic wastes from 200 persons in town of Gorham.	1	0	0	2	0
North Branch River (Little River Basin)	Untreated industrial wastes from a cannery in Gorham.	6	0	2	0	0

Table 12 - Approximate effects of pollution on present  
water conditions, 1953 (Cont'd)  
Presumpscot River Basin

Watercourse	Effects Resulting from Discharge of:	Approximate Effects & Extent in Miles				
		I	II	III	IV	V
Long Lake	Untreated domestic wastes from private sewers serving 100 persons in the town of Naples.	<u>1/</u>				
Stevens Brook (main stem)	Untreated sewage from 200 persons or more in Bridgton and sanitary sewage and dye and finish wastes of a woolen mill in Bridgton.	0	0	2	0	0
Highland Lake	Untreated domestic sewage from 80 persons in the town of Bridgton.	<u>1/</u>				
Bay of Naples	Untreated domestic wastes from private sewers serving 50 persons in the town of Naples.	<u>1/</u>				

1/ Pollution effects confined to immediate vicinity of outlets, over-all effect on lake negligible.

## POLLUTION PREVENTION MEASURES IN EFFECT

16. Treatment facilities in operation. - None of the 11 sources of sewage pollution nor of the four sources of industrial waste pollution in the Presumpscot River Basin has been provided with any treatment facilities.

17. Maine State pollution control legislation. - In 1941, the Maine legislature enacted the Sanitary Water Board Law which was amended in 1945, 1947 and 1949. This law was inadequate to enforce pollution abatement inasmuch as it was, in effect, a limited licensing law. In 1951, the legislature repealed and replaced Section I of the Revised Statutes, Chapter 72, and created the Water Improvement Commission which replaced the Sanitary Water Board. In 1953 Chapter 72 was further revised and provisions made for standards of classification, classification procedure and enforcement of classifications adopted and other regulations included in the Act. The Water Improvement Commission is directed to make studies, investigations and recommendations to persons responsible for conditions of pollution in the waters of the State as to ways and means such pollution may be controlled in the public interest. The Commission shall make recommendations to each legislature with respect to the classification of the rivers, waters and coastal flats based on the classification standards provided in Section I-A.

18. Although the revised Section I of the Revised Statutes, Chapter 72, stipulates that the Commission may employ, subject to

provisions of the personnel law, such employees and consultants as needed to carry out the provisions of this chapter, the Commission does not at present have adequate personnel or funds to carry out needed studies and investigations nor for public information programs.

19. Surface waters classified by Maine Legislature. - The Water Improvement Commission has not yet recommended classifications for any of the streams in the Presumpscot River Basin and none have been adopted by the legislature.

#### PROVISIONAL POLLUTION CONTROL, COSTS AND BENEFITS

20. Inasmuch as classifications have not been adopted for any of the streams in the Presumpscot River Basin, the Maine Water Improvement Commission reports that the pollution control measures that may finally be required cannot be determined at this time.

21. Purpose of provisional plans. - In lieu of a recommended program for pollution control by the Maine Water Improvement Commission and in order for this section to be as full and comprehensively factual as possible, three provisional plans for pollution control are presented. These provisional plans show (1) the water quality improvement that should result from the pollution control measures shown, (2) the approximate over-all costs for sewage and industrial waste treatment under each provisional plan and (3) the benefits that could accrue from the water quality improvement shown for these plans.

22. Essence of provisional plans. - Hereinafter in this section, these three provisional plans will be referred to as Provisional Plans A, B and C. The essence of each plan is as follows:

Provisional Plan A is based on the provision of primary treatment for most sources of sewage pollution and an equivalent or similar degree of treatment for sources of industrial waste pollution.

Provisional Plan B is based on the provision of secondary treatment for most of the sources of sewage pollution and an equivalent or substantial degree of treatment for each source of industrial waste pollution.

Provisional Plan C is based on the provision of secondary or a similar degree of treatment for all sources of pollution except where providing primary or a similar degree of treatment would result in approximately the same improved water conditions as secondary or similar treatment.

All plans provide for the chlorination of all sewage effluents.

23. Exceptions to the above plans are made in a few instances where only one method of treatment for a source of pollution is shown under all three plans. These cases occur when the method shown is obviously the only reasonable and applicable method of treatment for the source of pollution under consideration. For example, subsurface disposal will be shown for all small sources of sewage pollution under all three plans. Also where connection of wastes to municipal sewers is the obvious and most reasonable method of disposal, it is shown. A few such exceptions are made in order that this section can serve a useful purpose.

24. The science of sewage and industrial waste treatment is too complex to lend itself readily to exact definitions; but, for the purposes of this section, primary treatment of wastes is interpreted as the process by which, in a series of devices and structures, approximately 30 to 50 percent of the significant polluting materials is removed. Secondary treatment is interpreted as primary treatment plus such additional treatment as would result in an overall reduction of significant polluting materials of 60 percent or more. Storage and regulated discharge of wastes having an effect on the receiving stream similar to removal of 30 to 50 percent of the polluting materials from the uncontrolled waste is interpreted as primary treatment, and an effect equivalent to 60 percent removal or more is interpreted as secondary treatment.

25. Cost estimate criteria. - All cost estimates have been adjusted to the 1949 Engineering News-Record construction cost index. In computing annual charges for provisional pollution control projects, an interest rate of two and one-half percent and an amortization period of 30 years have been taken for all public construction. For private construction, an interest rate of four percent and an amortization period of ten years have been used in computing annual charges for provisional projects.

26. The cost estimates for municipal sewage treatment works construction include costs for intercepting sewers but do not include costs for sewerage systems or extensions thereto since such costs are not generally considered a part of sewage treatment. For industrial waste treatment or disposal construction, no costs have been included for in-plant or yard changes that may be required in connection with treatment. Such costs could only be determined after detailed in-plant investigations at each individual manufacturing plant. In some instances the cost of in-plant or yard changes would be minor and in a few others these costs may approach that of the treatment facility to be constructed. No corrections in the estimated construction costs for industrial waste treatment facilities have been made for savings that may be realized through greater utilization of raw materials or recovery of valuable by-products as a result of pollution control measures taken.

27. The annual charges for sewage treatment vary, of course, with each individual municipality. In general, the per capita cost for new construction is highest for small communities and decreases with increasing populations. Further, the final costs for municipal sewage treatment depend on the choice of plant design, industrial wastes to be intercepted, the construction materials and equipment specified and the method of financing. The annual charges for industrial waste treatment also vary with each individual project and vary more widely than municipal charges. As with municipal wastes, the final costs are determined by the type of wastes to be treated, choice of plant design and the construction materials and equipment specified.

28. Water quality criteria. - Subsequent discussion of water qualities is based on (1) the "Tentative Plan for Classification of Waters" of the New England Interstate Water Pollution Control Commission (as revised and accepted December 8, 1950) and (2) stream flows exceeded 95 percent of the time. In the absence of quantitative data on stream velocities, temperatures, reaeration coefficients and other self-purification factors below individual sources of pollution; these data have been estimated. Reference is made to Table 16, which is a reproduction of the interstate standards for the description of the suitability of the classes of water for use. Conditions I through V in this section approximately

correspond to Classes A through E of the "Tentative Plan for Classification of Waters."

29. The provisional plans presented in this report are not conceived to be the most feasible or desirable plans for controlling pollution in the Presumpscot River Basin. Such plans can be determined only after best use has been determined and classifications adopted by the State authorities. Neither are the methods of treatment or disposal shown necessarily the only methods available to produce a similar reduction in pollution. This section is designed to present data sufficient on which to judge the benefits and costs of pollution control in this basin.

30. No attempt is made to classify any of the waters in the Presumpscot River Basin or to usurp in any way the primary rights and responsibilities of the State of Maine to control the pollution of its waters.

#### PROVISIONAL PLAN A

31. Treatment or disposal facilities. - The treatment or disposal facilities that would be provided under the provisional plan are summarized in Table 13.

Table 13 - Treatment and disposal facilities -- Provisional Plan A,  
Presumpscot River Basin

No. of Facili- ties	Type of Wastes	Esti- mated P.E.*	Type of Treatment or Disposal	Estimated Reduction P.E.*in %
4	Sewage	11,100	Primary; chlorination	40
6	Sewage	385	Subsurface disposal	100
1	Sewage	40	Connect to municipal sewers	40
1	Textile	3,000	Connect to municipal sewers	40
1	Textile	130	Chemical precipitation	60
1	Cannery	8,000	Lagoons; nitrate treatment	80
1	Pulp and Paper Mill	97,000	Sedimentation or flotation	50

\*P.E. - Population equivalent in number of persons based on biochemical oxygen demand.

32. Reduction in pollution load. - Provision of the above treatment or disposal facilities would result in a reduction of stream pollution load in the Presumpscot River Basin of an estimated population equivalent of about 61,000 persons, approximately 50 percent of the total pollution load. Of this reduction about 4,800 would result from sewage treatment and about 56,300 from industrial waste treatment.

33. The reduction of pollution load under Provisional Plan A would result in significant improvement in the quality of receiving waters for higher uses. The details of Provisional Plan A for each source of pollution are contained in Table 15 which includes data on existing water conditions above and below the source of pollution and those which should result from the treatment shown.

34. Approximate water quality improvement under Provisional Plan A. - Under present conditions of pollution in the Presumpscot River Basin, there are 5 streams or tributaries thereof that receive pollution. The total length of these streams is approximately 51 miles, of which the present water conditions are estimated to be as follows: Condition I--28 miles, Condition II--none, Condition III--13 miles, Condition IV--2 miles, and waters falling below these conditions--8 miles.

35. If the treatment or disposal facilities shown under Provisional Plan A were provided, the approximate water conditions that would result in these streams would be as follows: Condition I--28 miles, Condition II--13 miles, Condition III--2 miles, Condition IV--8 miles, and waters falling below these conditions--none.

36. Significant water quality improvement would be affected in all streams transporting pollution and all of the Little River, North Branch Little River, and Stevens Brook would be improved to a condition equivalent to that suitable for all water uses except public water supply without filtration and disinfection. Under the treatment shown for Provisional Plan A, the nuisance conditions that result during critical periods in 8 miles of the Presumpscot River below Westbrook would be eliminated although the water would still be in a condition of low quality, equivalent to that generally suited for limited purposes. Tannery Brook would be improved from a condition of low water quality to one equivalent to

that suitable for recreational boating, irrigation of crops consumed after cooking and habitat for wildlife and common food and game fish indigenous to the region.

37. Table 14 summarizes the approximate water conditions that would exist under Provisional Plan A. Water conditions are shown in miles for each stream and conditions shown are equivalent to the classes shown under Table 16, "Tentative Plan for Classification of Waters."

Table 14 - Approximate effects of Provisional Plan A  
on water conditions,  
Presumpscot River Basin

Receiving Watercourse	Approximate Present Water Conditions Miles					Approximate Water Conditions Under Provisional Plan A - Miles					Net Water Quality Improvement in Miles			
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV
Presumpscot River	9	0	6	0	8	9	6	0	8	0	-	6	-	8
Little River	12	0	3	0	0	12	3	0	0	0	-	3	-	-
Tannery Brook	1	0	0	2	0	1	0	2	0	0	-	-	2	-
North Branch Little River	6	0	2	0	0	6	2	0	0	0	-	2	-	-
Stevens Brook	0	0	2	0	0	0	2	0	0	0	-	2	-	-
TOTALS	28	0	13	2	8	28	13	2	8	0	-	13	2	8

38. Net water quality improvement. - Table 14 indicates that with the treatment and disposal measures shown under Provisional Plan A all of the approximately 23 miles of streams would be

improved for higher uses than are possible under existing conditions of pollution. About 13 miles of watercourse would be in a condition equivalent to a water quality suitable for every water use except public water supply unless filtered and chlorinated. An additional 2 miles would be improved to a condition equivalent to a water quality suitable for recreational boating, habitat for wildlife and common food and game fish indigenous to the region and for irrigation of crops consumed after cooking. Eight miles of streams in nuisance condition during critical periods would be made suitable for transporting the treated wastes without nuisance.

39. The following tables and maps summarize and graphically depict Provisional Plan A and the effect of providing the treatment shown on receiving water qualities. Table 15 shows the approximate present water conditions, the treatment considered for each source of pollution and the approximate water conditions that would result from the treatment under existing conditions of pollution. Table 16 is a reproduction of the "Tentative Plan for Classification of Waters" of the New England Interstate Water Pollution Control Commission and shows the suitability of the classes of water quality for use. Plate 9 is a map showing the approximate water conditions that would result under Provisional Plan A.

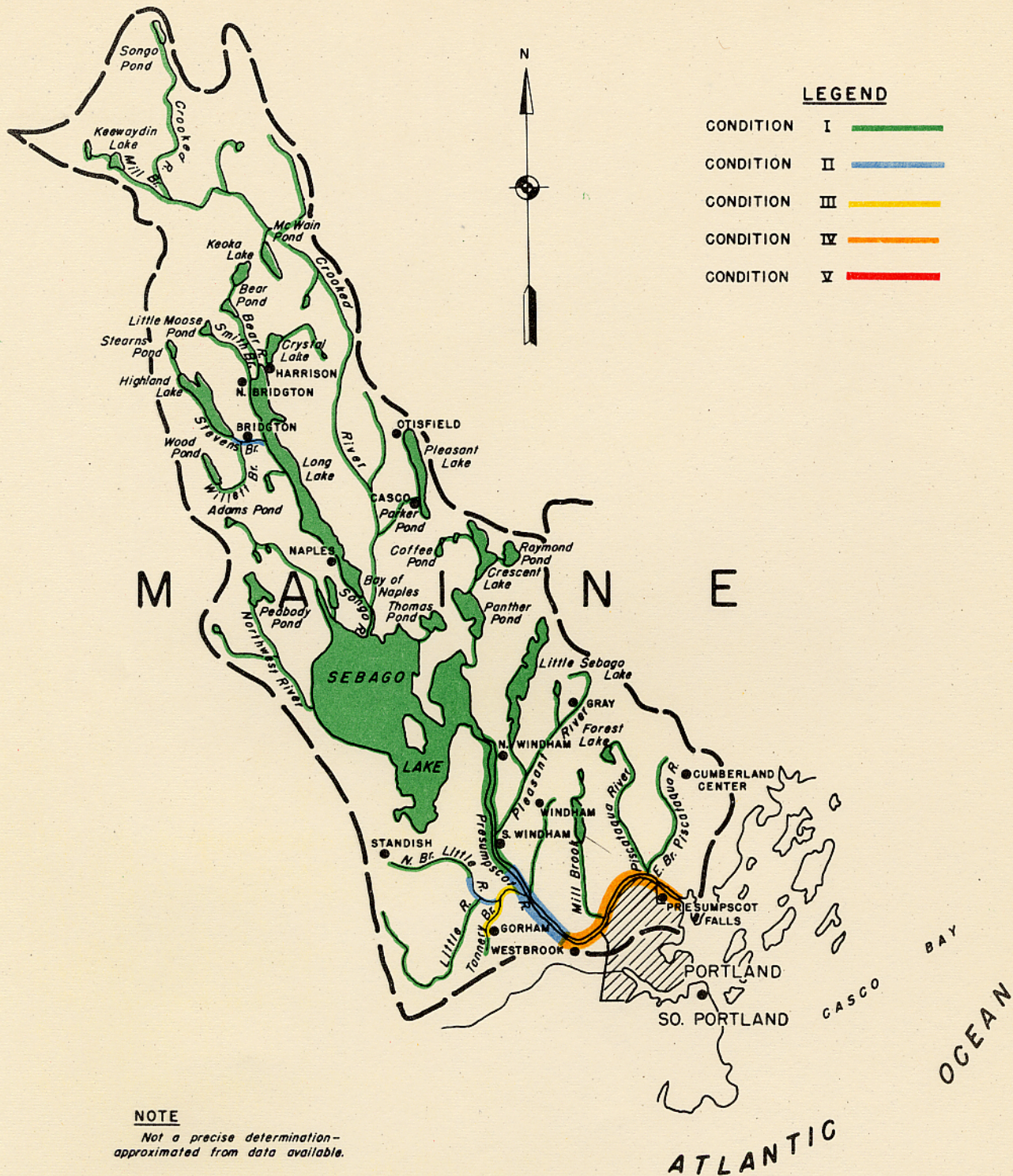


Table 15 - Provisional Plan A - Approximate present stream conditions\* and approximate stream conditions resulting from treatment or disposal, Presumpscot River Basin

Source of Pollution and Receiving Watercourse 1/	Type of Wastes Discharged	Approximate Present Stream Conditions		Provisional Plan A	
		Above	Below	Type of Treatmant or Disposal	Approx. Resulting Stream Condition
<u>Presumpscot River</u> (main stem)					
Windham (T)					
--South Windham	Domestic	I	III	Subsurface disposal	II
--Men's Reforma- tory	Domestic	I	III	Primary; chlorination	II
--Machine shop	Sanitary	I	III	Subsurface disposal	II
--Machine shop	Sanitary	I	III	Subsurface disposal	II
<u>Westbrook (C)</u>					
--Westbrook	Municipal	III	V	Primary; chlorination	IV
--Cotton textile mill	Sanitary & dye	III	V	Connect to municipal system	IV
--Textile mill	Sanitary	III	V	Connect to municipal system	IV
--Pulp & paper mill	Sanitary, pulp & paper	III	V	Chemical treatment, sedimentation or flotation	IV
<u>Long Lake</u> (main stem)					
Naples (T)					
--Naples	Domestic	-	I	Subsurface disposal	I
<u>Highland Lake</u> (Long Lake)					
Bridgton (T)	Domestic	-	I	Subsurface disposal	I
<u>Stevens Brook</u> (Long Lake)					
Bridgton (T)	Domestic	-	III	Primary; chlorination effluent to Long Lake	II

Table 15 (Continued)

Source of Pollution and Receiving Watercourse 1/	Type of Wastes Discharged	Approximate Present Stream Conditions		Provisional Plan A	
		Above;Below		Type of Treatment or Disposal	Approx. Resulting Stream Condition
<u>Stevens Brook (Cont.)</u>					
--Woolen Mill	Sanitary & dye and finish	-	III	Subsurface (Sanitary); chemical coagulation sedimentation (industrial)	II
<u>Bay of Naples</u>					
Naples (T)	Domestic	-	I	Subsurface disposal	I
<u>North Branch River (Presumpscot Basin)</u>					
Gorham (T)					
--Cannery	Canning	I	III	Subsurface (sanitary); lagoons & nitrate treatment (indus- trial)	II
<u>Tannery Brook (Little R. Basin)</u>					
Gorham (T)	Domestic	-	IV	Primary; chlorination	III

\*Not a precise evaluation - approximated from data available.

1/ C - city; T - town.

40. Costs for treatment and disposal facilities, Provisional Plan A.

The total construction cost for treatment and disposal facilities under Provisional Plan A has been estimated to be \$857,000 based on 1949 cost levels. Of this total \$471,000 is represented in the estimated cost of municipal construction for primary sewage treatment works, \$45,000 for subsurface disposal systems and connections to municipal sewerage

TABLE 16  
PRESUMPSCOT RIVER BASIN

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION  
TENTATIVE PLAN FOR CLASSIFICATION OF WATERS  
(As Revised and Accepted December 8, 1950)

	CLASS A	CLASS B	CLASS C	CLASS D
SUITABILITY FOR USE				
	Suitable for any water use. Character uniformly excellent.	Suitable for bathing and recreation, irrigation and agricultural uses; good fish habitat; good aesthetic value. Acceptable for public water supply with filtration & disinfection.	Suitable for recreational boating, irrigation of crops not used for consumption without cooking; habitat for wildlife and common food and game fishes indigenous to the region.	Suitable for transportation of sewage and industrial wastes without nuisance, and for power, navigation and other industrial uses.
STANDARDS OF QUALITY				
Dissolved oxygen	Not less than 75% sat.	Not less than 75% sat.	Not less than 5 p.p.m.	Present at all times.
Oil and grease	None	No appreciable amount	Not objectionable	Not objectionable
Odor, scum, floating solids, or debris	None	None	None	Not objectionable
Sludge deposits	None	None	None	Not objectionable
Color and turbidity	None	Not objectionable	Not objectionable	Not objectionable
Phenols or other taste producing substances	None	None	None	
Substances potentially toxic	None	None	Not in toxic concentrations or combinations	Not in toxic concentrations or combinations
Free acids or alkalies	None	None	None	Not in objectionable amounts
Coliform bacteria	*Within limits approved by State Department of Health for uses involved	Bacterial content of bathing waters shall meet limits approved by State Department of Health and acceptability will depend on sanitary survey.		

\* Sea waters used for the taking of market shellfish shall not have a median coliform content in excess of 70 per 100 ml.

NOTE: Waters falling below these descriptions are considered as unsatisfactory and as Class E.  
These standards do not apply to conditions brought about by natural causes.  
For purpose of distinction as to use, waters used or proposed for public water supply shall be so designated.

systems to serve 600 persons discharging sewage from private sewers; and \$341,000 is the estimated construction cost for industrial waste treatment facilities and connection to municipal sewerage systems to serve four separate industrial plants.

41. Annual charges for public sewage treatment. - Based on the estimated construction cost of \$471,000 and an amortization period of 30 years at  $2\frac{1}{2}$  percent, the total capital cost of municipal sewage treatment or disposal construction would be about \$675,000 and the annual capital charge would be about \$22,500 for 30 years. Operation and maintenance costs over this period are estimated to average about \$1.50 per capita served per year for an estimated 12,200 persons or an annual total of about \$18,000. The total estimated annual charge for municipal sewage treatment under Provisional Plan A is about \$40,500 for 30 years.

42. Annual charges for private sewage treatment. - For the treatment and disposal of sewage from private sewers serving about 600 persons, the estimated construction cost for subsurface disposal systems and connections to municipal sewerage systems is \$45,000. This cost, amortized over a period of ten years at 4 percent interest, would represent a total capital cost of about \$55,000 and an annual capital charge of \$5,500. At an average of four persons served per disposal unit and an average annual maintenance cost of \$10 per year per unit, the total annual operating and maintenance charge would be about \$1,500 per year. The total

annual charge for construction and maintenance of treatment facilities to serve private sources of sewage pollution would, therefore, be \$7,000 for ten years.

43. Annual charges for industrial waste treatment. - The total construction cost for industrial waste treatment facilities as outlined under Provisional Plan A has been estimated to be about \$341,000. This amount amortized over a period of ten years at 4 percent interest would represent a total capital cost of \$420,000 which would be an annual capital charge of approximately \$42,000 for ten years. From a consideration of the type of industrial waste treatment or disposal to be provided under this plan, the annual operating and maintenance charges for these facilities are estimated to total \$17,000. The total annual charges for industrial waste treatment and disposal under Provisional Plan A would then be an estimated \$59,000 for ten years.

44. Table 17 is a summary of the estimated construction costs and annual charges for sewage and industrial waste treatment under Provisional Plan A.

Table 17 - Summary of estimated construction costs\* and annual charges for treatment and disposal facilities - Provisional Plan A, Presumpscot River Basin

Type of pollution to be served	Estimated construction cost	Estimated annual capital charge <u>1/</u>	Estimated annual operation and maintenance charge	Total <u>1/</u> estimated annual charge
Municipal sewage	\$471,000	\$22,500	\$18,000	\$40,500
Private sewage	45,000 <u>2/</u>	5,500	1,500	7,000
Industrial wastes	341,000	42,000	17,000	59,000
TOTALS	\$857,000	\$70,000	\$36,500	\$106,500 <u>3/</u>

\* Based on 1949 Engineering News-Record construction cost index.

1/ Based on amortization periods of 30 and 10 years and interest rates of  $2\frac{1}{2}$  and 4 percent respectively for public and private construction.

2/ Includes connection for sewage from one industry discharging sanitary sewage only.

3/ Applies only during 10 year amortization period for private construction.

#### PROVISIONAL PLAN B

45. Treatment or disposal facilities. - The treatment or disposal facilities that would be provided under this plan are summarized in Table 18.

Table 18 - Treatment and disposal facilities - Provisional Plan B,  
Presumpscot River Basin

No. of facilities	Type of wastes	Estimated P.E.*	Type of treatment or disposal	Estimated reduction P.E.* in %
4	Sewage	11,100	Secondary; chlorination	85
6	Sewage	385	Subsurface disposal	100
1	Sewage	40	Connect to municipal sewers	85
1	Textile	3,000	Connect to municipal sewers	85
1	Textile	130	Biological treatment	85
1	Cannery	8,000	Lagoons; nitrate treatment	85
1	Pulp and paper mill	97,000	Biological treatment	85

\* P.E. - Population equivalent in number of persons based on biochemical oxygen demand.

46. Reduction in pollution load. - Provision of the above treatment or disposal facilities would result in an estimated reduction in stream pollution load in the Presumpscot River Basin of a population equivalent of 102,000 persons or a reduction of about 85 percent. Of this reduction in population equivalent, about 10,000 persons would result from sewage treatment and about 92,000 persons from industrial waste treatment.

47. The type of treatment or disposal for each source of pollution under Provisional Plan B, together with pertinent data on

present water conditions and water conditions that should result from the treatment or disposal shown, are outlined in Table 20.

48. Approximate water quality improvement under Provisional Plan B. - As reported under Provisional Plan A, there are five streams or tributaries thereof that transport significant pollution. The total length of these streams is approximately 51 miles, of which the present water conditions are estimated to be as follows: Condition I--28 miles, Condition II--none, Condition III--13 miles, Condition IV--2 miles, and waters falling below these conditions--8 miles.

49. If the treatment or disposal facilities shown under Provisional Plan B were provided, the approximate water conditions that would result in these streams would be approximately as follows: Condition I--28 miles, Condition II--13 miles, Condition III--10 miles, and waters falling below these conditions--none. The effects of Provisional Plan B on conditions of water quality for use are summarized in Table 19.

Table 19 - Approximate effects of Provisional Plan B  
on water conditions,  
Presumpscot River Basin

Receiving watercourse	: Approximate : Present Water : conditions : - miles					: Approximate water: : conditions under: : Provisional Plan : : B - miles : improvement : in miles					: Net water : quality : improvement : in miles			
	: I	II	III	IV	V	: I	II	III	IV	V	: I	II	III	IV
Presumpscot River	9	0	6	0	8	9	6	8	0	0	-	6	8	-
Little River	12	0	3	0	0	12	3	0	0	0	-	3	-	-
Tannery Brook	1	0	0	2	0	1	0	2	0	0	-	-	2	-
N. Branch Little R.	6	0	2	0	0	6	2	0	0	0	-	2	-	-
Stevens Brook	0	0	2	0	0	0	2	0	0	0	-	2	-	-
TOTALS	28	0	13	2	8	28	13	10	0	0	-	13	10	-

50. Net water quality improvement. - Table 19 indicates that with the treatment and disposal facilities discussed above under Provisional Plan B and as shown in more detail in Table 20, all of the 23 miles of watercourse would be improved to conditions suitable for higher uses than are possible under present conditions of pollution. Approximately 13 miles of stretches of streams would be in a condition equivalent to that suitable for all water uses except public water supply unless filtered and chlorinated. The remaining 10 miles of watercourse would be improved to a condition equivalent to one suitable for recreational boating, common food and game fish indigenous to the basin, wildlife habitat and irrigation of crops consumed after cooking. Under Provisional Plan B no waters would be

less suitable for use than shown for these last 10 miles of stretches of streams.

51. The following table and map summarize and graphically depict Provisional Plan B and the effect of providing the treatment shown on resulting water quality. Table 20 shows approximate present water conditions, the treatment considered for each source of pollution and the approximate water conditions that would result from the treatment under existing conditions of pollution. Plate 10 is a map showing the approximate water conditions that would result under Provisional Plan B.

52. Cost for treatment and disposal facilities, Provisional Plan B. The total construction cost for treatment and disposal facilities under Provisional Plan B has been estimated to be \$1,885,000, based on 1949 cost levels. Of this total, \$810,000 is represented by the estimated cost for municipal construction of four secondary sewage treatment works; \$45,000 for subsurface disposal systems and connections to municipal sewerage systems to serve 600 persons discharging sewage from private sewers; and \$1,030,000 is the estimated construction cost for industrial waste treatment facilities and connections to municipal sewerage systems to serve four separate industrial plants.

Table 20 - Provisional Plan B - Approximate present stream conditions\* and approximate stream conditions resulting from treatment or disposal, Presumpscot River Basin

Source of pollution and receiving watercourse 1/	Type of wastes discharged	Approximate present stream conditions		Provisional Plan B	
		Above:Below		Type of treatment or disposal	Approx. resulting stream condition
<u>Presumpscot River</u> (main stem)					
Windham (T)					
--South Windham	Domestic	I	III	Subsurface disposal	II
--Men's Reforma- tory	Domestic	I	III	Secondary, chlorina- tion	II
--Machine shop	Sanitary	I	III	Subsurface disposal	II
--Machine shop	Sanitary	I	III	Subsurface disposal	II
 Westbrook (C)					
--Westbrook	Municipal	III	V	Secondary, chlorina- tion	III
--Cotton textile mill	Sanitary & dye	III	V	Connect to municipal system	III
--Textile mill	Sanitary	III	V	Connect to municipal system	III
--Pulp & paper mill	Sanitary, pulp & paper	III	V	Chemical treatment, sedimentation or flotation	III
 <u>Long Lake</u> (main stem)					
Naples (T)					
--Naples	Domestic	-	I	Subsurface disposal	I
 <u>Highland Lake</u> (Long Lake)					
Bridgton (T)	Domestic	-	I	Subsurface disposal	I
 <u>Stevens Brook</u> (Long Lake)					
Bridgton (T)	Domestic	-	III	Secondary; chlorina- tion effluent to Long Lake	II

Table 20 (Continued)

Source of pollution and receiving watercourse <u>1/</u>	Type of wastes discharged	Approximate present stream conditions		Provisional Plan B	
		Above	Below	Type of treatment or disposal	Approx. resulting stream condition
<u>Stevens Brook (continued)</u>					
--Woolen Mill	Sanitary & dye and finish	-	III	Biological treatment	II
<u>Bay of Naples</u>					
Naples (T)	Domestic	-	I	Subsurface disposal	I
<u>North Branch River</u> (Presumpscot Basin)					
Gorham (T)					
--Cannery	Canning	I	III	Subsurface (Sanitary) Lagoons & nitrate treatment (indus- trial)	II
<u>Tannery Brook</u> (Little R. Basin)					
Gorham (T)	Domestic	-	IV	Secondary; chlorina- tion	III

\* Not a precise evaluation - approximated from data available.  
1/C - city; T - town.

53. Annual charges for public sewage treatment. - Based on the estimated construction cost of \$810,000 and an amortization period of 30 years at  $2\frac{1}{2}$  percent, the total capital cost of municipal sewage treatment construction would be \$1,161,000 and the annual capital charge would be about \$38,700 for 30 years. Operation and maintenance

costs over this period are estimated to average about \$2.50 per capita served per year for an estimated 12,200 persons or an annual total of about \$30,500. The total estimated annual charge for municipal sewage treatment or disposal under Provisional Plan B is \$69,000 for 30 years.

54. Annual charges for private sewage treatment. - The annual charge for providing treatment for sources of pollution from private sewers is the same as under Provisional Plan A. As computed above, the total annual charge for construction and maintenance of disposal systems to serve private sewers is an estimated \$7,000 for ten years under both provisional plans.

55. Annual charges for industrial waste treatment. - The total construction cost for industrial waste treatment facilities as outlined under Provisional Plan B has been estimated to be about \$1,030,000. This amount amortized over a period of ten years at 4 percent interest would amount to a total capital cost of \$1,270,000 which would represent an annual capital charge of about \$127,000 for ten years. The annual operating and maintenance charges for the four industrial waste treatment and disposal facilities are estimated to total \$24,000. The total annual charges for industrial waste treatment and disposal under Provisional Plan B would then be an estimated \$151,000 for ten years.

56. Table 21 is a summary of the estimated construction costs and annual charges for sewage and industrial waste treatment under Provisional Plan B.

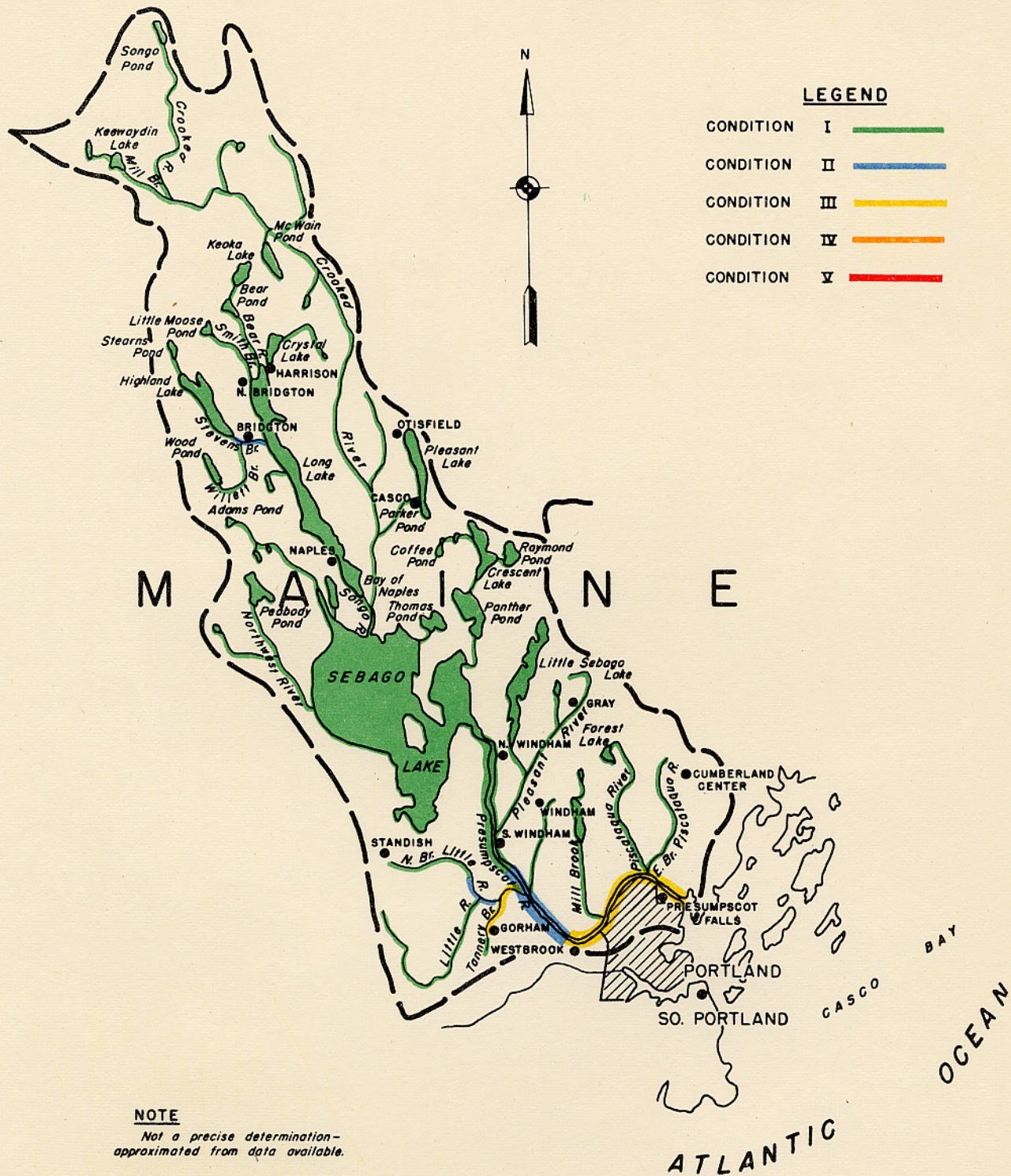


Table 21 - Summary of estimated construction costs\* and  
annual charges for treatment and disposal  
facilities - Provisional Plan B,  
Presumpscot River Basin

Type of pollution to be served	Estimated construction cost	Estimated annual capital charge <u>1/</u>	Estimated annual operation and maintenance charge	Total <u>1/</u> estimated annual charge
Municipal sewage	\$ 810,000	\$ 38,700	\$30,300	\$ 69,000
Private sewage <u>2/</u>	45,000	5,500	1,500	7,000
Industrial wastes	1,030,000	127,000	24,000	151,000
TOTALS	\$1,885,000	\$171,200	\$55,800	\$727,000 <u>3/</u>

1/ Based on amortization periods of 30 and 10 years and interest rates of  $2\frac{1}{2}$  and 4 percent respectively for public and private construction.

2/ Includes connection for sewage from one industry discharging sanitary sewage.

3/ Applies only during 10 year amortization for private construction.

# PROVISIONAL PLAN C

57. Treatment and disposal facilities. - Table 22 summarizes the treatment and disposal facilities that would be provided under Provisional Plan C.

Table 22 - Treatment and disposal facilities - Provisional Plan C,  
Presumpscot River Basin

No. of facilities	Type of wastes	Estimated P.E.*	Type of treatment or disposal	Estimated reduction P.E.*in %
3	Sewage	600	Primary; chlorination	40
1	Sewage	10,500	Secondary; chlorination	85
6	Sewage	385	Subsurface disposal	100
1	Sewage	40	Connect to municipal sewers	85
1	Textile	3,000	Connect to municipal sewers	85
1	Textile	130	Chemical precipitation	60
1	Cannery	8,000	Lagoons, nitrate treatment	85
1	Paper and Pulp Mill	97,000	Biological treatment	85

\* P. E. - Population equivalent in number of persons based on biochemical oxygen demand.

58. Reduction in pollution load. - Provision of the above treatment and disposal facilities would result in a reduction of stream pollution load in the Presumpscot River Basin of an estimated population equivalent of 101,600 persons, approximately 85 percent of

the present pollution load. Of this population equivalent reduction, about 9,600 would result from sewage treatment and about 92,000 from industrial waste treatment.

59. Approximate water quality improvement under Provisional Plan C. - Under Provisional Plan C, all streams transporting pollution at the present time would be improved for higher uses and the improvement in suitability for use would be approximately the same as under Provisional Plan B. Reference is made to the discussion on water quality improvement under Provisional Plan B. Table 19 shows the effects of Provisional Plan B on water conditions in each of the streams transporting pollution and these data also apply under Provisional Plan C.

60. Table 23 summarizes and Plate 10 graphically depicts Provisional Plan C and the effect of the treatment shown on resulting water conditions. Table 23 shows approximate present water conditions, the treatment considered for each source of pollution, and the approximate water conditions that would result from the treatment under existing conditions of pollution. Plate 10 shows the approximate water conditions that would result under Provisional Plan C.

Table 23 - Provisional Plan C - Approximate present stream conditions\* and approximate stream conditions resulting from treatment or disposal, Presumpscot River Basin

Source of pollution and receiving watercourse 1/	Type of wastes discharged	Approximate present stream conditions		Provisional Plan C	
		Above:Below		Type of treatment or disposal	Approx. resulting stream condition
<u>Presumpscot River</u> (main stem)					
Windham (T)					
--South Windham	Domestic	I	III	Subsurface disposal	II
--Men's Reforma- tory	Domestic	I	III	Primary; chlorination	II
--Machine shop	Sanitary	I	III	Subsurface disposal	II
--Machine shop	Sanitary	I	III	Subsurface disposal	II
Westbrook (C)					
--Westbrook	Municipal	III	V	Secondary; chlorina- tion	III
--Cotton textile mill	Sanitary & dye	III	V	Connect to municipal system	III
--Textile mill	Sanitary	III	V	Connect to municipal system	III
--Pulp & paper	Sanitary & pulp & paper	III	V	Chemical treatment sedimentation or flotation	III
<u>Long Lake</u> (main stem)					
Naples (T)					
--Naples	Domestic	-	I	Subsurface disposal	I
<u>Highland Lake</u> (Long Lake)					
Bridgton (T)					
--Bridgton	Domestic	-	I	Subsurface disposal	I

Table 23 (Continued)

Source of pollution and receiving watercourse <u>1/</u>	Type of wastes discharged	Approximate present stream conditions <u>Above;Below</u>		Provisional Plan C	
				Type of treatment or disposal	Approx. resulting stream condition
<u>Stevens Brook</u> <u>(Long Lake)</u>					
Bridgton (T) --Bridgton	Domestic	-	III	Primary; chlorination effluent to Long Lake	II
--Woolen Mill	Sanitary, dye & finish	-	III	Subsurface (Sanitary) chemical coagulation sedimentation (Indus- trial)	II
<u>Bay of Naples</u>					
Naples (T) --Naples	Domestic	-	I	Subsurface disposal	I
<u>North Branch R.</u> <u>(Presumpscot R.)</u>					
Gorham (T) --Cannery	Canning	I	III	Subsurface (Sanitary) Lagoons & nitrate treatment (indus- trial)	II
<u>Tannery Brook</u> <u>(Little R. Basin)</u>					
Gorham (T)	Domestic	-	IV	Primary; chlorination	III

\* Not a precise evaluation - approximated from data available.  
1/C - city; T - town.

61. Cost for treatment and disposal facilities, Provisional Plan C. - The total construction cost for treatment and disposal facilities under Provisional Plan C has been estimated to be \$1,770,000, based on 1949 cost levels. Of this total \$696,000 represents the estimated construction cost for three primary sewage treatment plants and one secondary sewage treatment works. Subsurface disposal systems and connections to municipal sewers to serve four communities and three industries discharging sanitary sewage only from private outlets have been estimated to cost \$45,000. The balance of \$1,029,000 of the total construction cost is the estimated cost for industrial waste treatment or disposal facilities and connections to municipal sewerage systems at four manufacturing plants.

62. Annual charges for public sewage treatment. - Based on the estimated construction cost of \$696,000 and an amortization period of 30 years at  $2\frac{1}{2}$  percent, the total capital cost for municipal sewage treatment and disposal construction would be \$998,000 and the annual capital charge would be \$33,000 for 30 years. Operation and maintenance costs over this period are estimated to average about \$2.25 per capita served per year for an estimated 12,200 persons or an annual operation and maintenance charge of \$27,000. The total estimated annual charge for municipal sewage treatment and disposal under Provisional Plan C is about \$60,000 for 30 years.

63. Annual charges for private sewage treatment. - The annual charge for providing treatment or connection to municipal sewers for sources of sewage pollution from private outlets is the same under all three provisional plans and was computed to be approximately \$7,000 for 10 years including construction, operation and maintenance.

64. Annual charges for industrial waste treatment. - The cost of construction of industrial waste treatment facilities under this plan is almost the same as that under Provisional Plan B, the difference being \$1,000 less for a total of \$1,029,000. The annual charge for construction, operation and maintenance of industrial waste treatment facilities under Provisional Plan C is computed to be \$151,000 for 10 years, the same as under Provisional Plan B.

The above costs are summarized in Table 24.

Table 24 - Summary of estimated construction costs\* and annual charges for treatment and disposal facilities - Provisional Plan C, Presumpscot River Basin

Type of pollution to be served	Estimated construction cost	Estimated annual capital charge <u>1/</u>	Estimated annual operation and maintenance charge	Total <u>1/</u> estimated annual charge
Municipal sewage	\$ 696,000	\$ 33,000	\$27,000	\$ 60,000
Private sewage	45,000 <u>2/</u>	5,500 <u>2/</u>	1,500	7,000
Industrial wastes	1,029,000	127,000	24,000	151,000
TOTALS	\$1,770,000	\$165,500	\$52,500	\$218,000 <u>3/</u>

1/ Based on amortization periods of 30 and 10 years and interest rates of  $2\frac{1}{2}$  and 4 percent respectively for public and private construction.

2/ Includes connection for one industrial plant for sanitary wastes only.

3/ Total applies only during 10 year amortization for private construction.

#### BENEFITS RESULTING FROM WATER QUALITY IMPROVEMENT

65. Since the Maine Water Improvement Commission carries out its functions in water pollution control on the classification principle, the benefits that will eventually accrue from pollution control in the Presumpscot River Basin are dependent upon the best water uses and classifications adopted by the State legislature. Since no classifications have been adopted for any of the streams in the basin that receive pollution, it is not possible in this report to assign

the eventual benefits from pollution control. However, as a guide to judging the costs and benefits from pollution control in this basin, three provisional plans for sewage and industrial waste treatment or disposal have been presented and the benefits which may result under these plans are discussed in succeeding paragraphs.

66. Tangible and intangible benefits. - Benefits resulting from pollution control are real but may be both tangible and intangible. A tangible benefit would be represented by a direct saving in costs of water treatment for public or industrial water supply as a result of pollution control. Another example of a tangible benefit would be recovery of valuable by-products in the process of reducing pollution. Intangible benefits are those which do not readily lend themselves to computation in monetary terms. Protection of the public health, abatement of nuisance conditions and enhanced aesthetic values through pollution control are examples of intangible benefits. For the most part, benefits assigned to pollution control are intangible, largely through the absence of suitable criteria for monetary evaluations. There are occasions, however, where suitable data are available when tangible benefits from pollution control can be computed on a monetary basis.

67. Water uses potentially to be benefited. - Benefits that may accrue from water quality improvement through pollution control depend upon the uses the improved water resources will serve. There are also potential benefits through the conservation of water resources

for future use. In the Presumpscot River Basin, the water resources serve as public water supplies, industrial water supplies, agricultural water supplies, for all types of recreation, for shellfish propagation, as a habitat for fish and wildlife, for power development and for transportation of sewage and industrial wastes. Save the last two which do not require a good water quality, these water uses are the ones potentially to be benefited by pollution control.

68. Potential benefits in Presumpscot River Basin. - The same benefits could accrue through water quality improvement under all three plans presented in this report. Recovery of greater amounts of water for higher uses would result from Provisional Plans B and C, however, and therefore the magnitude of the potential benefits is greater. As a further guide to evaluating the costs and benefits from pollution control under the plans presented in this report for existing pollution, the following potential benefits are listed for consideration. All these benefits could result if such uses of the improved water resources were made. In the absence of suitable criteria, no monetary evaluations are made and although presented as intangible, these benefits are real and have been proven through the years as most desirable and worthy of attainment. For the most part, they have been the basis for the investment of millions of dollars in existing sewage and industrial waste treatment facilities in other river basins that have been constructed to

serve the best interests of the public.

a. There could be a significant benefit to the public health by reducing the chances for waterborne diseases by the treatment of, or elimination of municipal, institutional and industrial sewage pollution. Sewage polluted waters are always a potential health menace.

b. The construction of the needed municipal sewage treatment works could make the communities served more attractive to further residential development and to new industries requiring this municipal utility which could be of real significance to local economies.

c. Industrial, residential and recreational real estate now located on or dependent on waters presently receiving pollution may be made more desirable and, thereby, appreciably increased in value when pollution is abated.

d. Farms not using streams because of pollution could have these water resources available for almost every agricultural use.

e. Pollution control measures in the Presumpscot River Basin and in the Portland area could allow the re-opening of clam flats at the mouth of the river and be of significant economic benefit to the shellfish industry.

f. Industries and municipalities contributing significant pollution to the water resources could experience a

worthwhile benefit from improved public relations through abatement of pollution for which they are responsible.

g. Aesthetic nuisances and unsatisfactory water conditions created during periods of low flows and high temperatures could be eliminated.

h. The general welfare of the people could be enhanced by the conservation of a vital natural resource for its best uses and by a greater opportunity to benefit therefrom. Further, clean streams could enhance the general reputation of the basin in the eyes of visitors and vacationists.

69. Resource development and benefits. - There is, of course, a direct interrelation between water resource development and benefits from pollution control. The more extensive and varied water use becomes the more benefits can be obtained from pollution control to maintain the necessary water qualities for the purposes served. The present limited development of the Presumpscot River Basin would probably significantly limit the degree to which the above benefits could be realized.

70. Should further development of the Presumpscot River Basin be undertaken with an integrated plan, it could result in a significant increase in industrial and recreation development which would be accompanied by an increase in population. These developments would appreciably enhance the value of the water resources for public water supply, industrial water supply and recreation. Land

abutting on or served by water resources suitable for industrial, residential and recreational use would also be increased in value. Pollution control measures to maintain acceptable water qualities under these circumstances would produce benefits in proportion to the magnitude of the economic development.

71. The plan for developing the land and water resources of the Presumpscot River Basin will indicate in large measure the pollution control measures that would be needed to conserve the water resources for best use. The adoption of best water use would, in turn, indicate the benefits that would result from pollution control.

EVALUATION OF MONETARY BENEFITS OR LOSSES TO  
POLLUTION CONTROL FROM CONSERVATION AND DEVELOPMENT PROJECTS

72. Power projects. - The Presumpscot River is a natural power development stream because of the tremendous water storage in and above Sebago Lake and the steep fall of the river below Sebago Lake. As a result, the Presumpscot River has been almost completely developed for hydroelectric power production. There has also been development of the desirable sites on Crooked River, Stevens Brook and the Piscataqua River.

73. No new power or conservation storage sites have been found feasible of development on the Presumpscot River or its tributaries at this time. Extensive recreational development on existing lakes and reservoirs and at potential storage sites precludes the development of additional storage in the basin.

74. Other conservation projects. - No other water conservation projects have been proposed for evaluation of benefits or losses to pollution control.

Table 25 - Basic data on sources of municipal and industrial pollution,  
Presumpscot River Basin

Source of pollution and receiving watercourse <u>1/</u>	Number sewered or employees	Type of wastes produced <u>2/</u>	Treatment provided	Adequacy of treatment	P.E. <u>3/</u> to water- course
<u>Presumpscot River</u> (main stem)					
Windham (T)					
--South Windham	100	Domestic (Private Sewers)	None		100
--Men's Reformatory	200	Domestic	None		200
--Machine Shop	60	Sanitary	None		20
--Machine Shop	100	Sanitary	None		35
Westbrook (C)	10,500	Municipal	None		10,500
--Cotton Textile Mill	600	Cotton Mill	None		3,000
--Pulp & Paper Mill	2,800	Paper Mill	None		97,000
--Textile	125	Sanitary	None		42
<u>Long Lake</u> (main stem)					
Naples (T)	100	Domestic (Private Sewers)	None		100
<u>Highland Lake</u> (Long Lake)					
Bridgton (T)	80	Domestic (Private Sewers)	None		80

Footnotes appended at the end of table.

Table 25 (Continued)

Source of pollution and receiving watercourse <u>1/</u>	Number sewered or employees	Type of wastes produced <u>2/</u>	Treatment provided	Adequacy of treatment	P.E. <u>3/</u> to water- course
<u>Stevens Brook</u> (Long Lake)					
Bridgton (T)	200	Domestic	None		200
--Woolen Mill	80	Sanitary, Dye & Finish	None		130
<u>Bay of Naples</u>					
Naples (T)	50	Domestic (Private Sewers)	None		50
<u>North Branch River</u> (Little River Basin)					
Gorham (T)					
--Cannery	100	Cannery	None		8,000
<u>Tannery Brook</u> (Little River Basin)					
Gorham (T)	200	Domestic	None		200

1/ T - Town; C - City.

2/ Municipal indicates significant industrial wastes intercepted; Domestic indicates no industrial wastes intercepted; Sanitary indicates sanitary wastes only.

3/ P.E. - Population equivalent in terms of biochemical oxygen demand.

## SECTION VI - FLOOD CONTROL AND DRAINAGE

1. High flows in the Presumpscot River Basin occur almost annually, usually in the Spring, and vary considerably in magnitude according to the water content of the snow. The series of natural and artificial lakes above the outlet of Sebago Lake provides almost complete control of over 70 percent of the total area of the basin and thus provides a high degree of protection.

### HISTORY AND ANALYSIS OF FLOODS

2. Flood history. - The flood history of the Presumpscot River indicates that the greatest flow of record at the outlet of Sebago Lake, 7,000 cubic feet per second, was experienced on April 7, 1902. The next greatest flow of record, equal to about one-half that of 1902, occurred on April 3, 1936. On both of these occasions there was some overbank flooding of agricultural fields, but no serious damages were sustained. Prior reports refer to damages in past floods as being negligible and state that damaging floods in this basin are practically unknown.

3. Analysis of floods. - The available evidence indicates that there are no flood problem areas in the Presumpscot Basin. The series of lakes and ponds above the outlet of Sebago Lake affords almost complete control of over 70 percent of the total area of the watershed and thus provides a high degree of protection to the lower basin. The uncontrolled area of 212 square

miles below Sebago Lake is not sufficiently large nor the run-off rapid enough to produce damaging flood flows in the river near its mouth. However, it is of interest to note that this uncontrolled area contributed over 90 percent of the peak flow of 11,200 cubic feet per second at the Cumberland Mills Dam in March 1936. At this same time, the flow at the outlet of Sebago Lake was less than 1,000 c.f.s.

#### DAMAGES

4. Erosion damages. - Erosion damages on cropland were determined by estimating the rate of soil loss and the average annual reduction in yield due to erosion. The average annual value of the loss over a 30-year period at four percent discount rate is \$2,100 at 1949 price levels.

5. Sedimentation damages. - Each year some land, especially on steep slopes, or recently plowed land, suffers erosion in times of severe storms, and the eroded material may reach highways, drainage ditches and streams. The sediment produced by erosion may cause an amount of damage reflected in additional costs necessary to clean highway culverts, protect bridges and maintain navigation channels. These maintenance costs are such a small percentage of the total that accounts do not show them separately. Monetary evaluation of sedimentation damage has not been included in damage totals.

6. Total damages. - Total average annual erosion damages are shown in Table 26.

Table 26 - Annual erosion damages,  
Presumpscot River Basin

	<u>1949</u> <u>price level</u>	<u>Projected</u> <u>price level</u>
Cropland erosion damages	\$ <u>2,100</u>	\$ <u>1,850</u>
Total	\$ 2,100	\$ 1,850

#### NEEDS

7. Basin requirements. - The average annual damages totaling \$2,100 indicate that a need for erosion control exists in the basin. General requests were made for erosion control at the Public Hearing at Augusta on June 12, 1952, but no requests were made for flood control.

#### PLANS OF IMPROVEMENT

8. Existing flood control improvements. - There are no existing flood control improvements in the Presumpscot River

Basin. During the period of flood hazard in the Spring the Weather Bureau Office at Portland issues a bulletin, evaluating existing flood potential in the State of Maine.

9. Effect of land treatment program. - The land treatment measures planned for the primary purpose of securing an optimum level of agricultural production in the basin would, upon installation, have a beneficial effect on the erosion problems of the watershed. These measures include adjusting land use with land capability, adoption of improved cropland and forest land management practices, and installation of the necessary minor structures needed to make the land conversions and improved management measures fully effective. A complete description of the land treatment plan is included in Section XI, Chapter X, Maine Coastal Area.

10. The land treatment would effectively control cropland erosion by the development of plant roots capable of holding the soil on the land. With the prevention of erosion on cropland, benefits from reduced sedimentation would also be obtained.

#### BENEFITS

11. Since no general plan of flood control is presented, flood control benefits are limited to benefits that may be obtained by reduction of flood damages by a combination of alert forecasting and planning for mobilization of flood-fighting

forces. Land treatment measures would reduce erosion loss by \$2,100 annually.

Table 27 - Summary of benefits,  
Presumpscot River Basin

<u>Item</u>	<u>Annual benefits</u>	
	<u>1949 price level</u>	<u>Projected price level</u>
Prevention of erosion on cropland	\$ <u>2,100</u>	\$ <u>1,850</u>
Total benefits	\$ 2,100	\$ 1,850

#### SUMMARY AND CONCLUSIONS

12. Summary. - Floods have been relatively infrequent in the Presumpscot River Basin. The storage presently in the basin, especially in the headwater area, already provides considerable modification in flood damages. Works for the sole purpose of reducing flood damages are not economically justified at this time. An economical reduction of flood damages may be obtained by providing a flood forecasting and warning service coupled with local plans for protective measures to be taken on the basis of such forecasts and warnings. Benefits from control of erosion and sedimentation would be provided by the land treatment measures of the Coordinated Basin Plan.

## DRAINAGE

13. Drainage problems are of minor importance in the Presumpscot River Basin. There is one area in the basin susceptible of improvement by group drainage projects. At Buxton three farms covering 100 acres would benefit by improvement of the channel of Little River. These improvements would not involve any major drainage outlets. This problem is considered in Section XI, Chapter X, Land Management of Maine Coastal Area.

## SECTION VII - POWER DEVELOPMENT

### AVAILABLE POWER

1. Existing developments. - There are nine generating plants in the Presumpscot River Basin with installed capacities in excess of 300 kw each. The aggregate installed capacity of these nine plants, excluding mechanical power, is 11,244 kw of which 10,884 kw are at eight plants on the main river and 360 kw at one plant on Stevens Brook. Utility plants account for 32 per cent (3610 kw) of the total hydroelectric generating capacity in the basin. In addition to the eight hydroelectric plants on the main river, there is one plant with an installation of over 2,000 horsepower mechanical power. These nine plants on the main Presumpscot River utilize 250 feet of the 267-foot fall in the main river below the outlet of Sebago Lake. Available data on existing hydro plants in the basin are summarized in Table 28. A listing in the Ninth Biennial Report of the Maine Public Utilities Commission (1939-1940) indicates that there are a number of small plants with wheel capacities totaling nearly 2,000 horsepower on tributary streams within the basin.

Table 28 - Existing hydro-power plants,  
Presumpscot River Basin

<u>Owner</u>	<u>Plant Name or Location</u>	<u>Drainage Area (sq.mi.)</u>	<u>Gross Head (ft.)</u>	<u>Installed Capacity (kw)</u>	<u>Average Annual Generation (1,000 kwh)</u>	<u>Use*</u>
Central Maine Power Co.	Bridgton (Stevens Bk)	-	50	360	400	U
S.D. Warren Co.	Bel Weir	436	40	1,800	11,650	I
Central Maine Power Co.	North Gorham (Great Falls)	440	34	2,250	11,700	U
S.D. Warren Co.	Dundee	443	51	2,400	16,200	I
E.I. Dupont de Nemours Co.	Newhall (Gambo Falls)	496	24	584	1,900	I
--	Little Falls	500	17	(1)	-	I
Central Maine Power Co.	Mallison	501	20	1,000	5,600	U
S.D. Warren Co.	Saccarappa	569	28	1,350	10,580	I
S.D. Warren Co.	Cumberland	570	22	600	632	I
S.D. Warren Co.	Smelt Hill	635	14	900	4,040	I

NOTE: In addition there are a number of small plants  
or tributary streams with aggregate capacity  
of over 2,000 hp.

(1) 2,007 hp mechanical drive

\*U - Utility

I - Industrial

2. Power supply. - The public demand for electric power in the basin is met principally by plants of the Central Maine Power Company with total interconnected generating capacity of over 355,000 kw as given in Table 29.

Table 29 - Interconnected generating capacity of the Central Maine Power Company

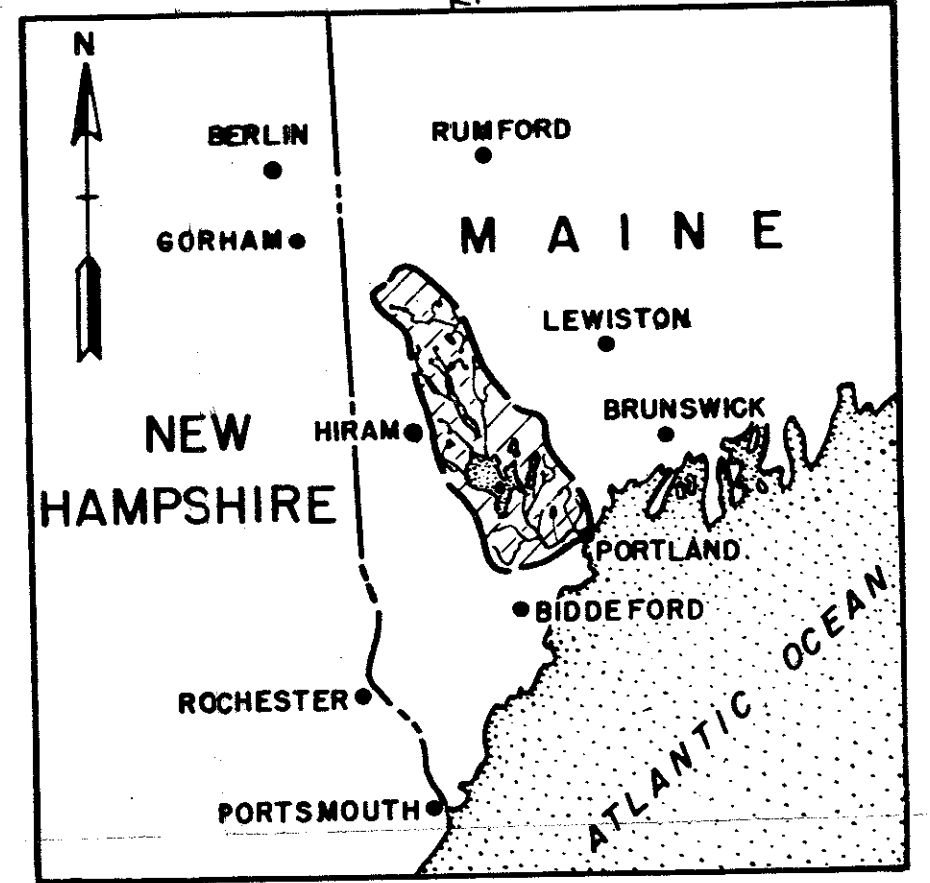
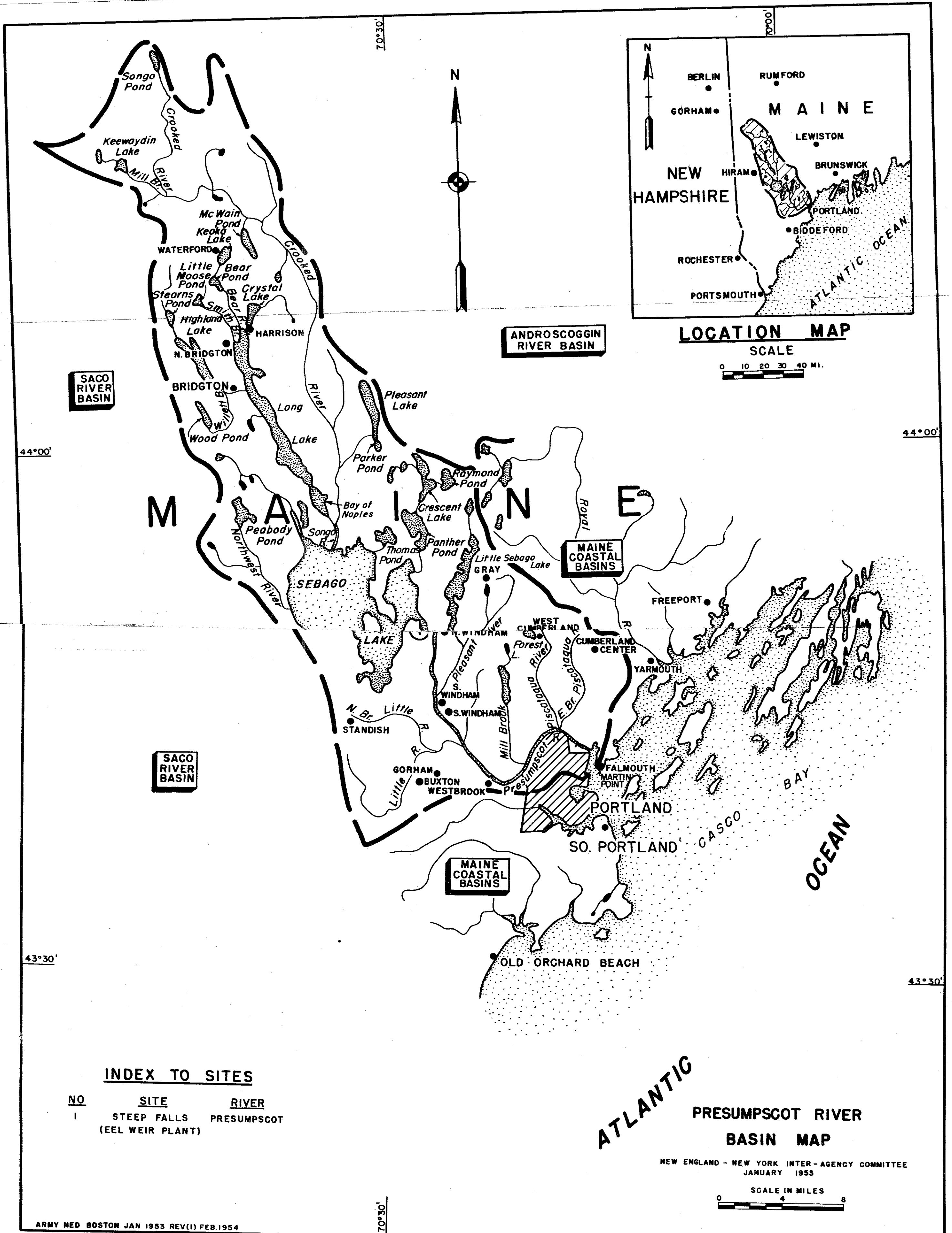
<u>Type of Plant</u>	<u>Installed Capacity</u> (kw)	<u>Per Cent of Total</u>
Hydroelectric	190,579	53.7
Steam Electric	158,000	44.5
Gas Turbine	4,000	1.1
Internal Combustion	<u>2,442</u>	<u>0.7</u>
Total Generating Capacity	355,021	100.00

With the completion of the Indian Pond development, now under construction on the Kennebec River, the total hydroelectric capacity of this company will be increased to nearly 267,200 kw. The company's total installed hydro capacity within the Presumpscot River Basin is 3,610 kw at three plants, but since all the plants of this company are interconnected, total system capability is available where needed. The company's transmission system is interconnected with systems of neighboring utilities.

#### HYDROELECTRIC POWER PLAN

3. Studies of the basin reveal no possibilities for the further development of power and storage facilities at the present time. The fall in the river below Sebago Lake is almost wholly utilized by existing plants and no sites were found where any

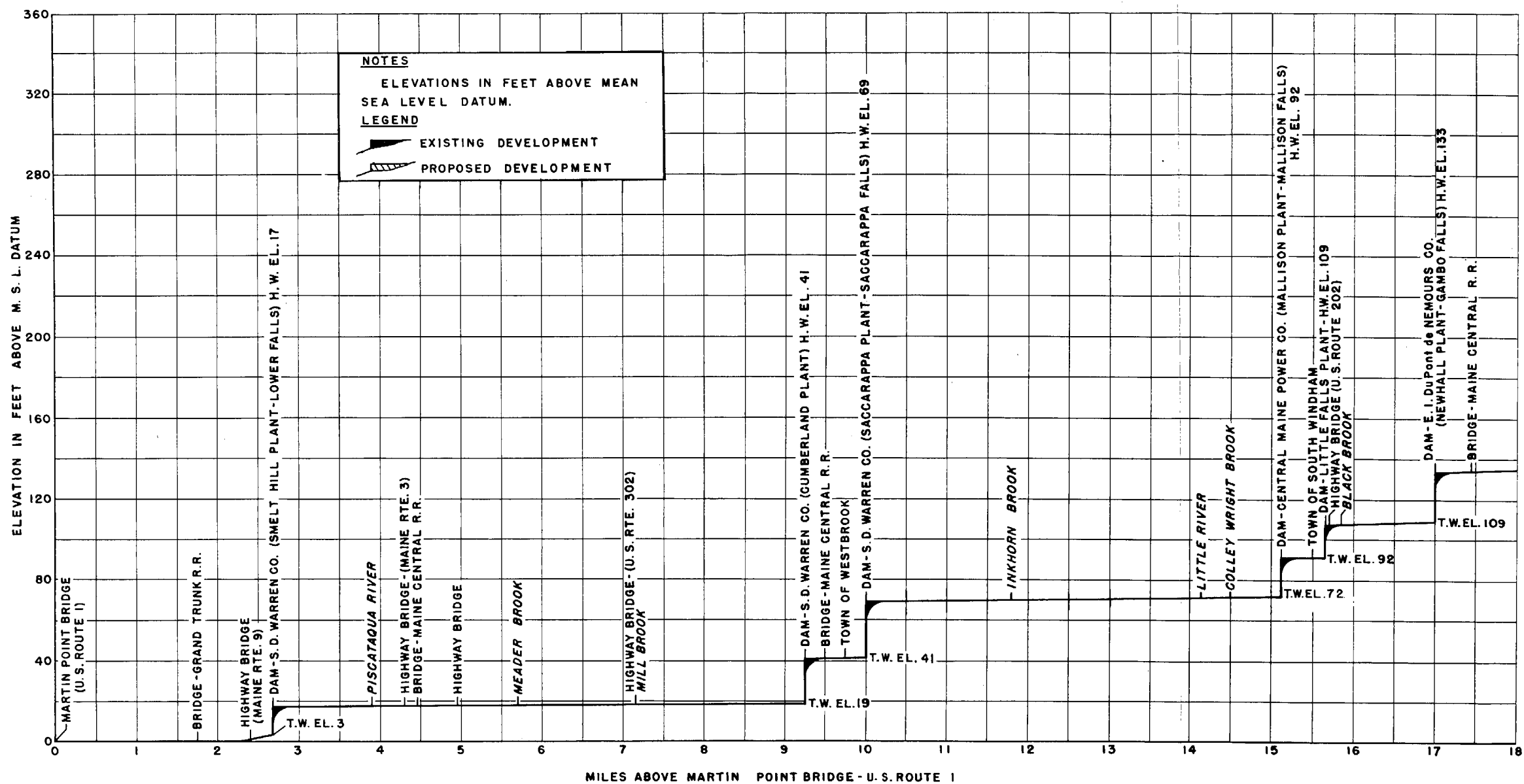
appreciable amount of power could be economically developed. Studies also revealed no new feasible sites for the development of power on tributary streams. As additional storage could be utilized to increase the dependable capacity of existing plants on the Presumpscot River, consideration was given to the possibility of increasing the amount of usable storage in existing reservoirs and developing new storage facilities. However, the extensive recreational developments in the vicinity of present and potential storage sites preclude the development of these sites. No new sites were found where economically feasible storage could be obtained.



**LOCATION MAP**

SCALE

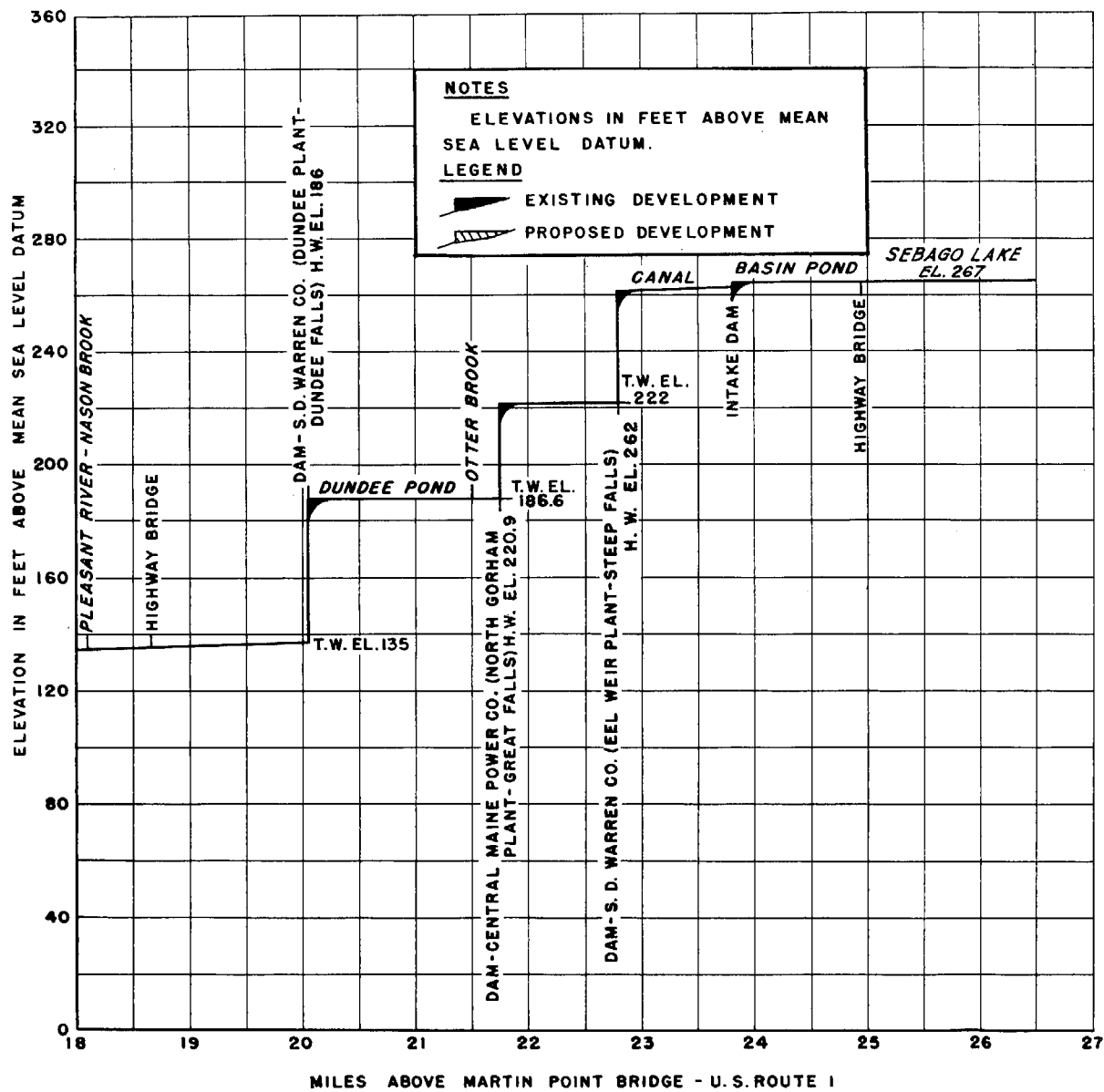
0 10 20 30 40 MI.



**PRESUMPCOT RIVER**  
(MARTIN PT. BRIDGE TO SEBAGO L.)  
**PROFILE**

NEW ENGLAND-NEW YORK INTER-AGENCY COMMITTEE  
JANUARY 1953

SCALES: AS SHOWN



# PRESUMPCOT RIVER (MARTIN PT. BRIDGE TO SEBAGO L.) PROFILE

NEW ENGLAND-NEW YORK INTER-AGENCY COMMITTEE  
JANUARY 1953

SCALES: AS SHOWN

## SECTION VIII - NAVIGATION

1. There is no record of commercial navigation on the Presumpscot River. Depths are sufficient for recreational boating, however, and the river constitutes one leg of an established canoe route. (See Section X.) No project exists for the improvement of the River by the United States, in the interest of navigation. Upon review of the navigation potentialities of the river in 1929, it was found that the cost of any improvement would not be commensurate with the benefits obtained. A survey report by the Corps of Engineers in 1948 found sufficient justification to warrant a Federal project for a channel 150 feet wide and 20 feet deep from deep water in Casco Bay to a turning basin of the same depth, 500 feet wide and 1,000 feet long, about 0.6 miles above the mouth of the river. Local interests were to furnish suitable bulkheaded disposal areas for dredged material or, in lieu thereof, a cash contribution of \$50,000. Inasmuch as local interests would not agree to meet these conditions of cooperation, no project was recommended. Any future navigation improvements, if found justified, would undoubtedly be confined to the tidal portion of the river and would not be adversely affected by upstream improvements for other purposes.

## SECTION IX - FISH AND WILDLIFE

### THE RESOURCES

1. Wildlife resources. - The ring-necked pheasant is the only agricultural game species of special significance in the Presumpscot River Basin. Cottontail rabbits are found in the basin, but their distribution is spotty and the basin constitutes the fringe of their range. The State Game Farm for rearing pheasants is located at Dry Mills, adjacent to the Presumpscot Basin, and many pheasants are released in and about this watershed for the benefit of the concentration of hunters in and about the Portland area. Habitat conditions for pheasants are probably better than in most areas of Maine, but survival of stocked birds is poor. Rearing and stocking pheasants on a crate-to-gun basis in this area is probably the most desirable technique for providing some pheasant shooting.

2. The white-tailed deer is the most important forest wildlife species in the Presumpscot Basin, as it is elsewhere in the state. This watershed is located in one of the more productive deer areas of the state. A combination of productive habitat and high concentrations of hunters from the Portland area accounts for the high yield throughout all but the urbanized sections of the watershed. A reported kill of 171 deer is recorded for the Town of Raymond in 1951. This town, almost all of which lies in the

Presumpscot Basin, is located only about 15 miles northwest from Portland. The land area of Raymond extends over about 34 square miles. According to the 1951 harvest total of 171 deer, there was one deer taken for every 129 acres in the township. Over the four-year period 1949-1952, there was an average harvest of about 1050 deer on the 534 square miles of land surface in the basin.

3. Good quality deer habitat is found in all segments of the Presumpscot River Basin, with the exception of the Portland-Westbrook urbanized areas. The pattern of land ownership and use, climatic conditions, topography, and such features as roads and transmission lines render the area productive as deer habitat. The over-all complex of food and cover conditions appears well-balanced in the basin. These requirements are continually maintained through lumbering on scattered areas of small woodland ownership, clearing of road borders and transmission lines, farming and orcharding, and reversion of open land to brushy growth.

4. High quality deer hunting, located so closely to the municipalities in the Portland area, is of great importance to the large number of sportsmen residing in the vicinity. Although out-of-state hunters utilize the area to some degree, the majority of the hunters live in or near the Presumpscot Basin. Nonresident hunters entering Maine commonly journey farther into the state to seek deer hunting.

5. Black bears are found in the basin and a few have been taken in recent years. According to bounty claim figures, only three or four bears are taken annually. These are usually killed in the more remote upper reaches of the basin, north of the towns of Naples and Casco. The few bears taken are probably secured by hunters engaged in hunting for deer or other game species. An agricultural bounty of \$15.00 is paid by the state for all bears killed in the basin. Black bears are not an important game animal in the Presumpscot Basin and it is not expected that they will ever assume any appreciable significance in this area.

6. Another forest game species in the big-game category which is found in the basin is the moose. These animals are sparsely distributed in favorable locations north of Sebago Lake, and they are occasionally seen passing through the area. Pockets of fairly good moose habitat are found about swamps and cut-over land in the basin. Moose will never occur in large numbers in this area, but the occasional appearance of an animal stimulates considerable local interest in the species. Moose have been completely protected by law in this basin for many years and continued protection is assured.

7. The remainder of the forest game species in the basin are comprised of such small game animals as ruffed grouse, varying hare, woodcock and grey squirrel. All of these species are important in the basin, with each having a considerable number of

devotees. Grouse and varying hares stand first in importance among the small game species. Good quality habitat for grouse and hares is found throughout the basin. Many of the land-use factors which were enumerated earlier as favoring the productivity of the deer herd also function as benefits to grouse and hares. An abundance of good quality habitat exists in this basin for the two important species.

8. The migratory American woodcock is a common summer resident in the Presumpscot Basin. Breeding populations are not large as compared to eastern Maine, but hunting for this game bird is fairly popular and large numbers of woodcock pass through the watershed during migration seasons. Habitat for the species is characteristically spotty, but well-distributed throughout the basin. Woodcock hunting is of major importance to only a small proportion of sportsmen, but many combine woodcock and grouse hunting to provide variety in shooting and in the game bag.

9. Grey squirrels are found throughout the Presumpscot River Basin, but squirrel hunting does not assume the importance in Maine that it does in more southerly areas of the squirrel range. The indigenous northern hardwood and softwood species, together with an appreciable scattering of oaks in some sections, make this area better squirrel habitat than most areas in Maine.

10. Fur animals of fair abundance found in the Presumpscot Basin include muskrats, beavers, minks, otters, skunks, raccoons

and red foxes. The first three species account for the bulk of the fur harvest. Few otters are trapped, and the remaining species command such a poor price that trapping is limited. Trapping for muskrat, beaver and mink is fairly intensive in this area of high human population, especially by farm boys and other part-time trappers. Habitat conditions appear about average for the important fur species as compared to other areas in southern and western Maine. No sizable areas of special trapping significance exist in this basin, such as are found in the oxbows along the former bed of the Saco River near Fryeburg.

11. Waterfowl conditions within the Presumpscot Basin are no better than average for this section of Maine. The best waterfowl sites available consist of fringes of aquatic vegetation about parts of the more shallow ponds in the basin. The Crooked River, comprising the main upstream component of the Presumpscot Basin, provides some waterfowl habitat. In general, however, this basin is not an important component in the production of waterfowl in Maine. With its high proportion of water surface, the basin does provide an abundance of resting areas during fall and spring migration periods. The lower estuary of the river near Portland is utilized as a feeding and resting area at all times of the year by one or another species of waterfowl. Waterfowl hunting is not very important in the Presumpscot Basin.

12. Fishery resources. - The fishery resources of the Presumpscot Basin are varied and their utilization is high throughout most of the year. In common with most segments of western, central and coastal Maine, angling for both warm-water and cold-water fishes is popular. Ice fishing is also important in the area. Lake fishing, in particular, is popular with residents and vacationists alike. This section of Maine contains many organized summer camps for children as well as a multitude of individual cottages. Good fishing is of prime importance to the average camp owner, and the mixed fishery available provides angling throughout the summer season.

13. The nucleus of the fishery in this basin is Sebago Lake, one of the very few lakes in Maine naturally inhabited by the esteemed landlocked salmon. Salmon fishing is still of paramount importance in this lake, and large numbers are taken annually, especially during the spring months. Other cold-water fishes abundant in the lake are whitefish, cusk and smelt. Whitefish and cusk are not important in the fishery, but smelt are sought after and provide much recreation. Brook trout are occasionally caught in Sebago Lake and brown trout have also been stocked and comprise an element in the fishery.

14. Sebago Lake is a mecca for fishermen from a wide area during the period of spring salmon fishing. Being located near large centers of population, utilization is very high, both on a

daily and seasonal basis. In addition to the cold-water fishes enumerated above, there are various warm-water fishes commonly found in the lake. These latter include yellow perch, black crappie, white perch, pickerel, bullhead and smallmouth black bass. Although the physical and biological qualities of the lake favor the cold-water species, competition factors among the various species have caused some problems in Sebago Lake as they have in many other lakes in Maine.

15. There are about 60 lakes and ponds in the Presumpscot River Basin. Sebago Lake contains about 45 square miles, which is over half the water surface of 81 square miles found in the entire basin. Other sizable lakes include Long, Highland, Crescent, Pleasant, Panther and Little Sebago. These, and most of the other lakes and ponds in the basin, are moderately to heavily fished.

16. Twenty bodies of water in the basin were investigated by the Maine Department of Inland Fisheries and Game during the summer of 1938.<sup>1/</sup> More recent surveys have augmented information on the lakes. It was ascertained that nine of the lakes which were surveyed had the characteristics of cold-water lakes, while eleven others offered a warm-water environment. Actually, there

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<sup>1/</sup> Cooper, Gerald P.--A Biological Survey of Thirty-One Lakes and Ponds of the Upper Saco River and Sebago Lake Drainage Systems in Maine. Maine Department of Inland Fisheries and Game, August 1939.

is no clear dividing line between the cold and warm-water lakes of the basin. It was originally determined that Keoka Lake should be managed for trout fishing and Stearns Pond for warm-water fishing. Physical and chemical analyses indicated that 18 percent of the water volume covering 13 percent of the bottom area was suitable habitat for trout during late summer in Keoka Lake. Stearns Pond had 16 percent of its volume and 13 percent of its bottom area suitable for trout, but due to additional factors, Stearns Pond was classified as a warm-water pond. Keoka Lake has more recently been judged to offer better opportunities for managing the warm-water fish population.

17. The extremes of classification are, of course, readily determinable. Sebago Lake, for instance, provides a clear example of cold-water habitat. Seventy-five percent of its water volume, which extends over 79 percent of its bottom area, is suitable for trout and salmon in late summer. Many of the warm-water ponds contain absolutely no suitable habitat for trout and salmon during late summer. Every acre-foot of water in these latter lakes is either excessively warm, deficient in dissolved oxygen, or suffers from both conditions.

18. A characteristic of this and other basins in southern Maine is the wide dispersal of the warm-water fish species. While salmon are generally found in only the larger of the cold-water lakes and trout are restricted to the streams and a few cold-water

lakes, such fishes as yellow perch, white perch, bullhead, sunfish, smallmouth black bass and chain pickerel are found throughout the ponds of the basin. Each of the lakes classified as offering cold-water habitat contained three or more of the warm-water fish species.

19. The scattering of both warm and cold-water fishing areas comprises an asset to this basin from the recreation standpoint. As recounted earlier, the bass, perch and pickerel fishing provides an attraction during the summer months when salmon and trout fishing has passed its peak. Fishing for these warm-water species is very important to the cottage owner, summer visitor, and to children's camps. Pickerel fishing through the ice is also very important in the basin. The warm-water fishes comprise an asset only in those lakes where habitat for cold-water fishes is poor or absent.

20. Stream fishing in the Presumpscot Basin is highly seasonal, with emphasis on early spring trout fishing. Many of the streams, especially near Portland, are liberally stocked with trout in order to meet the requirements of the large group of anglers in the vicinity.

21. Trout habitat is well-distributed in the streams of the basin. Tributaries to the Crooked River, the Crooked River itself, the Presumpscot River between Sebago Lake and Westbrook, and tributaries to the Presumpscot River below Sebago Lake all provide fair to good trout fishing. Limitation on the amount of stream trout fishing is imposed by high water temperatures in various areas of

the basin. High summer temperatures are found in the downstream segments of many tributaries, in thoroughfares between lakes, and in streams which derive their sources from pond surface waters. Streams in the basin are generally of small size and often of moderate to steep gradient, offering generally poor habitat for such warm-water species as pickerel and smallmouth black bass.

#### NEEDS OF THE FISH AND WILDLIFE RESOURCES

22. The Presumpscot River Basin is within easy day-use radius of the most populous segment of Maine. Embracing as it does the famed Sebago Lake and many other lakes utilized by summer residents, the fishing pressure is high. Due especially to the productive deer hunting available, the basin is likewise popular with the residents of the area. Certainly, the over-all productivity of this small watershed demonstrates the fallibility of the old myth that fish and game abundance is necessarily associated with large acreages of undeveloped woodlands. A considerable portion of the more than 350,000 people who obtain hunting and fishing licenses in Maine derive much of their sport in the Presumpscot River Basin. The maintenance of fish and wildlife populations to a degree adequate to meet the large demand of these sportsmen is a very important consideration in this basin.

23. Wildlife resources. - An understanding of the popularity of pheasant hunting in segments of the basin, and a recognition of

deficiencies in pheasant habitat would seem to indicate the desirability of instituting habitat improvement measures. However, basic information acquired during the investigation of pheasants in Maine<sup>1/</sup>, points up the tenuous nature of maintaining shootable surpluses through management techniques in this area.

24. In recognizing the diversity of opinion regarding the place of pheasant hunting in the management of game species in Maine, the pheasant report offers two sets of recommendations. One set provides suggestions to follow if pheasants are to be liberated with the hope of as thorough a harvest as possible by gunners. The other set of recommendations is designed to offer methods whereby naturally-producing populations could possibly become established. Material contained in the main body of the report certainly lends greater support to the first set of recommendations.

25. While it is obvious that the provisions for careful management under the second set of recommendations would tend to sustain survival, it is, nonetheless, true that habitat deficiencies would impose severe limits on the size of attainable populations. Although pheasants have been hunted under liberal regulations, it would seem that the stocking of about 200,000 pheasants over a 20-year period has afforded this species ample opportunity to establish itself, provided sufficient habitat were available

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1/ Dorr, Donald E.--Final Report of the Maine Pheasant Investigation, Manuscript of the Maine Department of Inland Fisheries and Game, June 1951.

In view of the established facts concerning pheasants in Maine, nothing further can be offered to meet the needs of this species in the basin.

26. The forest-game habitat in the basin offers productive environment for the common woodland species of game. As indicated earlier, there is a diversity of cover types, including considerable brushland interspersed with field edges and timberland. Problems of low hunter utilization, undiversified land ownership, and uniformity of cover types, which characterize headwater segments of the northern Maine basins, do not apply in the Presumpscot Basin.

27. The deer herd, particularly in segments of the basin adjacent to Portland, should continue as a great asset to this relatively congested area. The continued prosperity of the deer herd is an important need in the wildlife picture of this area. This need has thus far been met as a result of the intrinsic good qualities of the habitat available, and as a result of liberal hunting regulations, which have prevailed in this basin as well as in all other sections of Maine. Under these regulations, it has been possible to crop the deer herd heavily, as shown earlier in this report.

28. A comparison of total deer harvests in the basin indicates that the kill in the 1952 hunting season was about 25 per cent less than that of 1951. It would be unwise and premature to

draw any serious conclusions from this fact. Whenever an appreciable drop in deer kill occurs, it is claimed by many that the herd is in serious condition. Although the deer kill in 1952 was 25 per cent less than in 1951, it should be pointed out that the kill in 1951 was 21 per cent higher than that of 1950, and that the 1950 harvest was 8 per cent less than that of 1949. The deer harvest fluctuates annually for a variety of reasons, many of which have nothing to do with the size of the herd. Yearly changes in hunting pressure, the foci of pressure, and climatic conditions have a profound effect on the total kill.

29. Deer kill in the Town of Standish has totaled 235, 258, 281 and 278 for the four years 1949-1952, respectively. This consistently high kill is indicative of a thriving deer herd. In the nearby Town of Gray, the total recorded kill has been 117, 165, 236 and 76 for the same four-year period. The 68 per cent drop during the 1952 hunting season in Gray may be regarded as serious but, on the other hand, may more nearly reflect the normal productive capacity of range conditions in the town.

30. The history of management of deer in Maine is often regarded as a classic in proper wildlife husbandry. The legal deer kill has risen from about 7,000 in 1919 to a high of nearly 42,000 in 1951. The major reason for the reduced kill of 35,000 in 1952 is regarded as a reflection of poor hunting weather over much of the state. During practically the entire history of deer

management in Maine, both sexes of deer have been legal game, with the only exception being the years 1907 and 1908 in Cumberland and York Counties. Deer have prospered under the liberal laws, as shown by the harvest figures for the Presumpscot Basin in recent years.

31. The deer herd of most areas in the Presumpscot Basin is subjected to uncommonly great hunting pressure. Productivity has remained high thus far, but it should be noted that such gross alterations in habitat as changes in land-use patterns, development of woodlands into advanced age classes, altered forest cuttings or consecutive severe winters, lower the number of deer available. The impact of continual high hunting pressure on a deer herd existing on deteriorating habitat would warrant intensive management of this important area.

32. It should not be construed from the foregoing that pressing problems exist in the area. Rather, the information suggests that changing conditions may require closer supervision of the deer herd, its habitat, and its utilization. The killing of many deer by dogs creates a problem within and about the basin. More effective control of this problem may be considered an existing need in the basin.

33. There appears to be excellent habitat for the small forest game species, such as grouse and hares, in the basin. No significant needs are apparent at the present time with regard to

these species. These species would benefit from any future development designed to improve conditions for deer.

34. Few good marsh areas exist for waterfowl and fur-bearer production in the basin. There do not appear to be many possibilities for development of habitat of this type; A need of the area is the creation of more marsh areas. The Northwest River is an example of an area which might offer an opportunity for development of this type. Further investigation of this and a few other areas would be necessary before any plans could be developed. Most of the lakes in the basin offer mediocre waterfowl and fur-bearer habitat. Any increase in the amount of habitat available would be a benefit to these resources. Special caution should be exercised in the selection of sites for increasing marsh habitat in order that productive fishing and spawning areas are not eliminated.

35. Fishery resources. - Three general deficiencies have been emphasized in relation to the fishery resources of most of the Maine river basins. These have been the effects of various dams, including beaver dams, pollution, and the presence of competition by undesirable fish species. With the exception of Stevens Brook, which connects Highland and Long Lakes, the only serious pollution problem is located in the Presumpscot River between Westbrook and its mouth. The effects of pollution are acknowledged to be harmful along this eight-mile reach of river.

This heavily polluted section, as well as the section between Sebago Lake and Westbrook is further reduced in productivity because of dams and reservoirs. There are nine dams located on the Presumpscot River between Sebago Lake and its mouth. These dams form barriers to anadromous fishes, block the free run of resident fishes along the river and up the tributaries, and deny the use of the Presumpscot River as spawning habitat for landlocked salmon from Sebago Lake.

36. The remaining deficiencies in the basin emanate from small dams lying elsewhere in the watershed and from the complexities arising from omnipresent and often severe species competition. Damages from species competition in this area are always imposed by warm-water fishes in a cold-water environment. Specific limitations of adaptability render it practically impossible for cold-water fishes to compete successfully with warm-water fishes except in cool streams of rather high gradient or in lakes with the preponderant characteristics of great depth, large cold-water zones rich in oxygen, and over-all sterility with respect to littoral areas.

37. Of the nine lakes in the basin which were classified as offering opportunities for development of cold-water fishing for brook trout, lake trout, and landlocked salmon, only Sebago Lake and Peabody Pond contain superlative physical qualities for management as cold-water lakes. Long Lake also offers above-average

management opportunities for cold-water species. These three lakes, as well as Adams, Bear, Coffee, Trickey, Pleasant and Crystal Lakes, which have been selected for cold-water species management, contain one or more deficiencies in the habitat complex.

38. Of the nine so-called cold-water lakes in the basin, a total of five have insufficient spawning areas for cold-water species. Spawning facilities may be naturally deficient, as in the case of Coffee Pond, or excellent potential spawning sites may be obstructed, as in the case of Sebago and other lakes in the basin. In addition, all the cold-water lakes suffer from undesirable species competition in varying degrees.

39. The over-all fisheries need in the Presumpscot Basin is to retain the productivity of the lakes which provide warm-water fishing for such species as smallmouth black bass, white perch, and pickerel and also to effect changes in the dynamics of the fish population in cold-water lakes in such a manner that salmon and trout fishing is improved. Because of the inherent capacity of warm-water fish species to maintain their populations without dependence on tributary streams, and because competition by cold-water species is not a limiting factor in regard to their productivity in a favorable environment, it naturally follows that management needs for warm-water lakes will be largely a matter of law enforcement. Restrictions on ice fishing for pickerel and spring and early

summer bass fishing are examples of the type of restrictions which may be applicable.

40. With regard for the needs of stimulating the productivity of the landlocked salmon and trouts in the cold-water lakes, it is apparent that fishery management requirements will vary from lake to lake. The recent publication, "Maine Lakes,"<sup>1/</sup> points up the problems of individual waters in this basin. Many of the existing laws are designed to protect the cold-water fishery in suitable lakes in the basin. The summary of fishing laws for 1952 states that there is no bag or size limits on white perch in Long and Sebago Lakes. Coffee Pond was closed to all fishing until April 15, 1953, indicating that this small pond was poisoned to rid it of all fishes, and then subsequently stocked with trout. A daily limit of five trout per person has been imposed at Adams Pond. Restrictions on the taking of smelts, an important forage fish for salmon, are in force on tributaries to several lakes such as Panther, Peabody and Sebago Lakes.

41. Poisoning of small ponds and development of protective laws are more or less readily attainable. Difficulties arise when practical improvement measures must be designed to reduce or

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<sup>1/</sup> Everhart, W. Harry, and Bond, Lyndon H., et al.--Maine Lakes, A Sportsman's Inventory. Maine Department of Inland Fisheries and Game, Roland H. Cobb, Commissioner, Augusta, Maine, 1953.

eliminate competition by warm-water species, and interferences with spawning runs, such as dams, screens and similar obstructions must be removed. The cost of poisoning large lakes usually is prohibitive and the effectiveness of this measure may have serious limitations, especially when connecting waters contain an abundance of the unwanted fish species. Clearing stream obstructions to accommodate the spawning of cold-water fishes very often presents insurmountable problems, such as legal tangles involving vested water rights of other interests.

42. It would appear that the larger lakes which offer good quality habitat for salmon and trout should be managed with these species in mind, even though warm-water fishes may dominate at present. Possible techniques for assisting in this program are outlined below:

- a. Introduction of no new fish species;
- b. Spot poisoning of spawning sites of unwanted species and destruction of littoral pockets;
- c. Employment of increased fluctuations through manipulation of dams wherever possible during and after spawning of undesirable species;
- d. Improvement of the potential of cold-water spawning and nursery streams by all possible means, such as restrictions on fishing, clearing obstructions where possible, construction of fishways and removal of screens;

e. Removal of laws protecting unwanted species; encouragement of fishing on spawning beds; supervised removal of spawning fish and poisoning of spawn at every opportunity.

#### COORDINATION WITH OTHER LAND AND WATER DEVELOPMENT PROGRAMS

43. From an examination of management and development plans for resources other than fish and wildlife in the Presumpscot River Basin, there appear to be no significant areas of conflict. Benefits would accrue in small measure from pollution abatement in the watershed.

44. By way of a general conclusion regarding the fish and wildlife resources, it is pointed out that this basin lies within easy access of densely populated areas. Camps and summer homes are especially numerous. For these reasons, the basin warrants a more intensive application of management measures than would be justified in more remote areas of the state. The Maine Department of Inland Fisheries and Game has various regulations and programs in effect which incorporate several features of the Fish and Wildlife Plan.

#### FISH AND WILDLIFE PLAN

45. Plan. - The Fish and Wildlife Plan is designed to maintain the high wildlife productivity in the basin and to propose continuing studies leading to improved condition of the fisheries.

a. Continued close supervision should be carried on with respect to the important deer herds in the basin, with special

reference to the problem of deer kills by dogs. Importance of the herd may, in the future, require more detailed management techniques than in other segments of the state.

b. Sportsmen should be continually advised of the shortcomings of the area for pheasant production in order that a pheasant-rearing program of undue weight can be avoided.

c. Sites offering possibilities for small marsh development for waterfowl and fur bearers should be investigated, with a view towards eventual acquisition and management.

d. The program of lake surveys should be continued, as proposed by State of Maine personnel, and these surveys should continue to expand the knowledge of tributary systems.

e. A firm application of the knowledge acquired from lake and stream surveys should be employed in the management of fisheries in the basin whenever possible.

## SECTION X - RECREATION

### THE RESOURCE

#### 1. Natural features of recreation importance. - The

Presumpscot River Basin exhibits a number of natural features of recreational value including lakes, forests, and wildlife. The lakes in the basin are the most significant features and are noted particularly for their attractive setting and excellent fishing. Sebago Lake, the largest in the basin, is one of the most intensively used lakes in Maine in connection with recreation. It supports species of cold water fish including land locked salmon and lake trout, and its vast expanse of water surface and interesting wooded shoreline, featuring beaches and rocky coves, contribute to its attractiveness and great popularity. Grouped around this lake are Little Sebago, Highland, Pleasant, Crescent and Panther Lakes, as well as numerous smaller ones. They too are important recreation attractions.

2. Most of the basin is covered with second-growth forests of mixed conifer and hardwood species which provide scenic background for the lakes and habitat for several species of wildlife. The generally hilly terrain and the several small mountain peaks in the upper reaches also contribute to the scenic and natural interest of the basin and afford added opportunities for recreation.

3. Historical and archeological features. - The Presumpscot valley, particularly the Sebago Lake district, has considerable archeological interest. There is a prehistoric village site in Sebago Lake State Park which could probably yield enough material to fill a small museum and thereby offer an added attraction to this popular area. A museum development would be of particular educational value in view of the heavy concentration of boys' and girls' camps in the vicinity.

4. Historical interest, however, is relatively minor, though there are fine old houses in Gorham, Standish and Naples. Most of these are still in use as dwellings or are being cared for by various private or public agencies.

#### PRESENT USE OF THE RESOURCES

5. General recreation. - The resources of the basin are used extensively in connection with various recreational activities including picnicking, camping, hiking, fishing, swimming, canoeing, hunting, nature study and winter sports. The quality of the resources, ease of access and proximity to large centers of population are factors which contribute to the unusually heavy use. The river itself is a popular canoe route. The route originates at Portland and extends through Sebago Lake along the Songo River



Use of the Presumpscot River Canoe Route. Presumpscot River Basin .

and across Long Lake to the town of Harrison, with a return route to Sebago Lake by way of the Crooked River. The central lakes district featuring Sebago Lake is the principal attraction of the basin and receives the greatest use. While attendance records show considerable use during the spring, fall and winter months, the heaviest use occurs during the months of June, July and August.

6. Extensive private developments in the form of overnight accommodations, including cabins, summer cottages, and sporting camps, are provided for vacationists, campers, fishermen, hunters and tourists. There are also a few public areas with facilities for day, weekend and vacation use. The recreation industry is a major economic factor in the basin. Use of the resources in connection with recreation is presently estimated to be around 200,000 visitors annually. Total expenditures by visitors in connection with all types of recreation use is close to \$8,000,000 annually.

7. Public parks and recreation areas. - Sebago Lake State Park, located on the northern shore of the lake, is the major public recreation area within the watershed. It ranks fourth in size in the Maine State Park system and receives the heaviest visitor use. This park contains 1,296 acres and offers facilities for camping, picnicking, hiking, boating and swimming. The park

is accessible by principal highways and is close to centers of population. The cities of Portland and Lewiston, Maine, the largest cities in the state, are within thirty miles of the park. Visitor attendance for 1952 was 115,844. Attendance figures for 1950 and 1951 were 95,693 and 110,150, respectively.

8. Approximately 8,000 acres of the White Mountain National Forest lie in the upper reaches of the watershed. This mountainous region with its forests and streams offers opportunities for camping, hiking, mountain climbing, fishing, hunting and nature study. No extensive recreation facilities have been installed in this portion of the forest, except for some foot trails and small camp sites. Recreational use of these forest lands is believed to be minor, although no figures are available.

9. The Maine State Highway Commission has five wayside areas in the basin for public use. Three are located in the vicinity of Little Sebago Lake off Routes 320 and 202, one near Falmouth off Route 9, and another above Bolster Mills on Route 117. Facilities provided at these areas consist of picnic tables and a small pull-off parking strip.

10. Private recreation developments. - There are approximately 80 privately operated organized camps in the vicinity of Sebago Lake. These camps constitute about one-third of all the



Bathing Beach, Sebago Lake State Park. Presumpscot River Basin .

camps of this type in Maine. The majority are for youths although there are a few family and adult camps. They have a combined daily capacity of about 4,000 campers, exclusive of staff and help. Most of the camps operate over a period of six to eight weeks during the summer season, with a limited number operating for brief periods during the winter. The total camper days per year is around 240,000.

11. There are three ski areas in the basin located at Cumberland, Gorham and Harrison. They are used primarily by the resident population and persons living in nearby communities outside the basin. The Cumberland and Gorham areas are located in the lower part of the basin within convenient travel distances of Portland. Each features good down-hill slopes and the necessary towing and parking facilities. The Harrison area is located near the upper end of Long Lake. It has a 1,200-foot slope and rope tow, together with facilities for parking and eating.

12. There are many private summer homes, cottages, tourist lodges and hotels throughout the central lakes district and in the vicinity of Bridgton and Harrison. The hotels and motels at Bridgton and Harrison operate the year round, catering particularly to skiing parties during the winter months.

## RECREATION NEEDS AND POTENTIALITIES

13. The needs of the growing population of the basin for non-urban recreation, together with the steadily increasing pressure from tourists and vacationists, call for the development of additional areas and facilities. Present use of Sebago Lake State Park exceeds its developed capacity. Private accommodations, including rental cottages, summer cabins, and organized camps, are at a premium throughout the summer months. The park is sufficiently developed at present to meet the recreational needs of most of the basin's 34,400 inhabitants. However, because of its location within easy access of the largest population centers of Maine, and its proximity to densely populated areas to the south, including the Boston metropolitan area, it is used extensively by visitors from these sections of the region. On the basis of present use, it appears that the present capacity of this park would have to be doubled if the current demand is to be accommodated adequately.

14. The Maine State Park Commission is presently engaged in improving and expanding the park facilities in an effort to alleviate this situation. However, in order to meet both current and future needs without incurring overuse, it would be desirable to acquire additional park lands in the general locality including



Boating at Sebago Lake State Park. Presumpscot River Basin .

two to three miles of additional shoreline on Sebago Lake or on one of the adjoining lakes. This would constitute a modest acquisition considering that the shoreline of Sebago Lake is over 40 miles long.

15. In order to relieve the pressure on the resources of the central lakes district, including Sebago Lake State Park, consideration should be given to developing one or more recreational areas convenient to Portland that would provide opportunities for day outings for the residents of the Portland-Westbrook metropolitan area. It appears that the seacoast in the vicinity of Portland offers the best possibilities for establishment of a sizable public recreation area. However, suitable sites are located outside the basin and are discussed in Section X of the Maine Coastal Area.

16. Since the portion of the White Mountain National Forest within the basin contains no developed sites for recreation, consideration should be given to development of at least one major area suitable for camping, picnicking and swimming in this sparsely populated and highly scenic portion of the drainage area. Keewaydin Lake, and its adjacent lands, appear to offer the best possibilities for such a development. It is accessible over Highway No. 5, and would undoubtedly prove popular for tourists traveling in this portion of the White Mountain region. Attractive recreation development in this part of the basin would tend to relieve the heavy recreation pressure on the central lakes district.

17. The extent of private holdings in the central and southern portions of the basin, particularly lake frontage, points to the need for providing public access to the water surfaces for fishing, boat launching, and related recreation activities. Consideration should also be given to establishing small camp-sites on the stream banks and lake shores along the established canoe routes. These campsites would be for the convenience of canoeing parties in connection with over-night stops, cooking meals, and for rest periods, and could also be used by fishing parties.

18. In view of the concentration of youth camps in the central lakes district of the drainage area, camping organizations and agencies seeking new campsites should be encouraged to locate in the less densely populated country to the north where excellent conditions for camping are to be found.

19. Taking into account the various factors which have a bearing on visitor use for recreation purposes, including popularity of the resources, accessibility, population distribution, climate, transportation, etc., it is estimated that the total visitor use of the resources would approximate 300,000 annually if the resources of the basin were developed along the lines outlined herein. This represents an increase of 100,000 over present use. The additional use could be expected to increase total expenditures in connection with recreation to approximately \$9,000,000, which represents an increase over present annual expenditures of \$1,000,000.



Keewaydin Lake offers an excellent opportunity for development of a public recreation area.  
Presumpscot River Basin .

## PLAN FOR DEVELOPMENT OF THE RESOURCES FOR RECREATION

20. General discussion of the plan. - The following plan is offered as a guide for further development of the resources of the basin for recreation purposes. It is based upon present and estimated future needs and is designed to provide for the protection of important natural features, expansion of existing areas and facilities and the development of additional areas.

21. The plan deals with the general phases of planning and is not intended to present detailed estimates and plans or to confine developments to exact locations. These details would logically follow the adoption of a general development plan.

22. Cooperation of all conservation agencies dealing with land and water resources is essential to the execution of the plan in order that the resources be protected from impairment and encroachment, particularly those agencies dealing with fish and wildlife conservation, pollution control, and forest management. Current programs of these agencies should be coordinated with the plan for recreation development.

23. Provisions of the Plan.- The plan includes:

a. Expansion of facilities for camping, picnicking, swimming, boating, fishing, and related activities within Sebago Lake State Park, the excavation of an archeological site within the park and the development of a museum.

b. Acquisition of approximately 500 acres of land for public park and recreation purposes in the central lakes district. This development could be in the form of an addition to Sebago Lake State Park or a new area in the general vicinity. It should provide for approximately three miles of lake frontage with adequate facilities for camping, picnicking, swimming, boating, fishing and related activities.

c. Development of a site on the shore of Keewaydin Lake in the White Mountain National Forest for picnicking, camping, swimming and hiking.

d. Establishment of approximately ten campsites along existing canoe routes which traverse the waters of the Presumpscot and Crooked Rivers and Sebago and Long Lakes. Minimum facilities should include one or two picnic tables, a fireplace, and sanitary facilities at each site.

e. Improvement of existing wayside areas and the development of possibly one or two additional ones. Sites for these developments should be selected to take advantage of scenic features and should include picnic tables, fireplaces, parking area, drinking water, and sanitary facilities where feasible. They may be limited to one to two acres or expanded to suit local conditions.

f. Establishment of scenic overlooks and protected scenic routes in connection with the present program of highway improvement.

24. Costs of the plan. - The estimated development costs given in Table 30, as well as the operation and maintenance estimates, are for public area developments only. They are based on known costs of comparable developments and operations rather than upon detailed analysis of the sites listed.

Table 30 - Estimated Costs of recreation development plan,  
Presumpscot River Basin

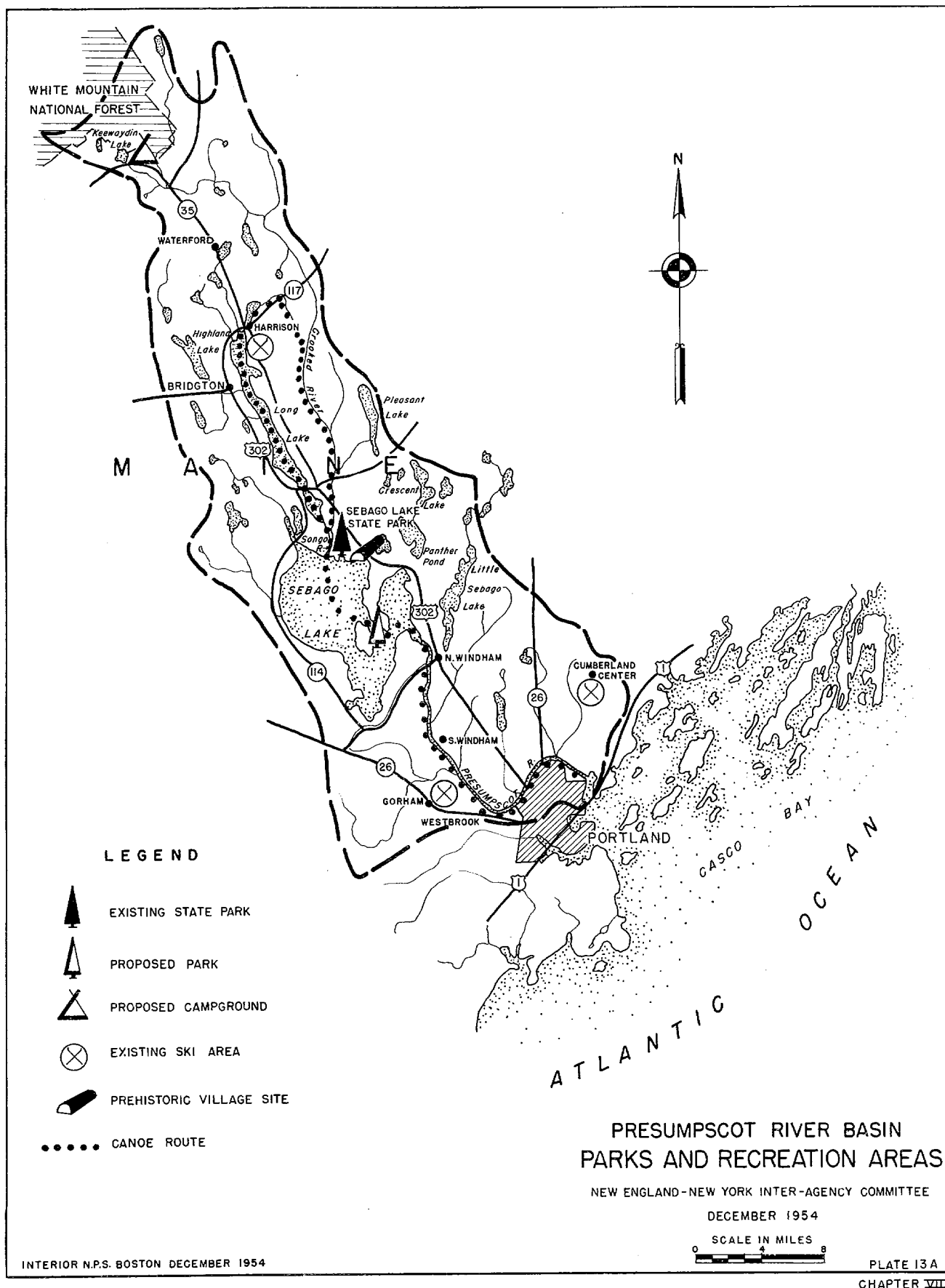
Area	Total Cost* of Development \$	Annual Opera- tion and Main- tenance Costs \$	Total** Annual Costs \$
Sebago Lake State Park	300,000	9,000	25,300
New Area - Central Lakes	500,000	15,000	42,100
Keewaydin Lake Area	50,000	2,500	5,200
Canoe Route Campsites	6,500	300	650
Wayside Areas	5,000	1,000	1,300
Totals	861,500	27,800	74,550

\* Includes the costs of both land acquisition and physical improvements.

\*\* Total development costs amortized for a period of 25 years @  $2\frac{1}{2}\%$  plus annual operation and maintenance costs.

25. Benefits of the plan. - Both tangible and intangible benefits would result from further development of the resources along the lines set forth in the recreation plan. Tangible benefits are represented by monetary expenditures of visitors using the recreation resources, areas and facilities. These benefits are estimated to be about 10 percent of the estimated increase in gross expenditures, or about \$100,000 annually.

26. Intangible benefits are those which cannot be readily computed in monetary terms. They constitute contributions to the physical and spiritual health and welfare of individuals as a result of participation in either the active or passive form of outdoor recreation.



## SECTION XI - LAND MANAGEMENT

1. From the standpoint of land management the Presumpscot River Basin is an integral part of the Maine Coastal Area. For this reason, the discussion of land use in this basin is included in the overall treatment of the subject of land management in Section XI of Chapter X - Maine Coastal Area.

## SECTION XII - MINERALS

### INTRODUCTION

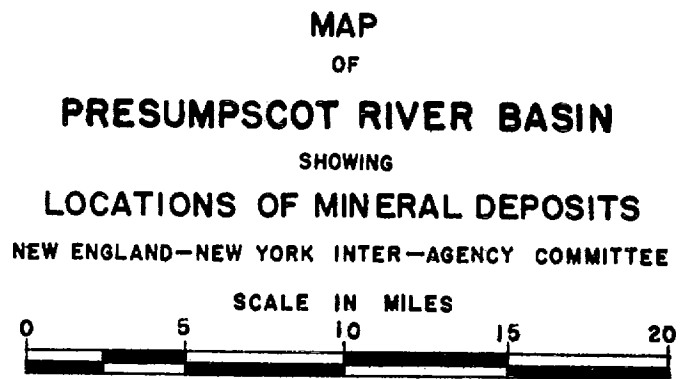
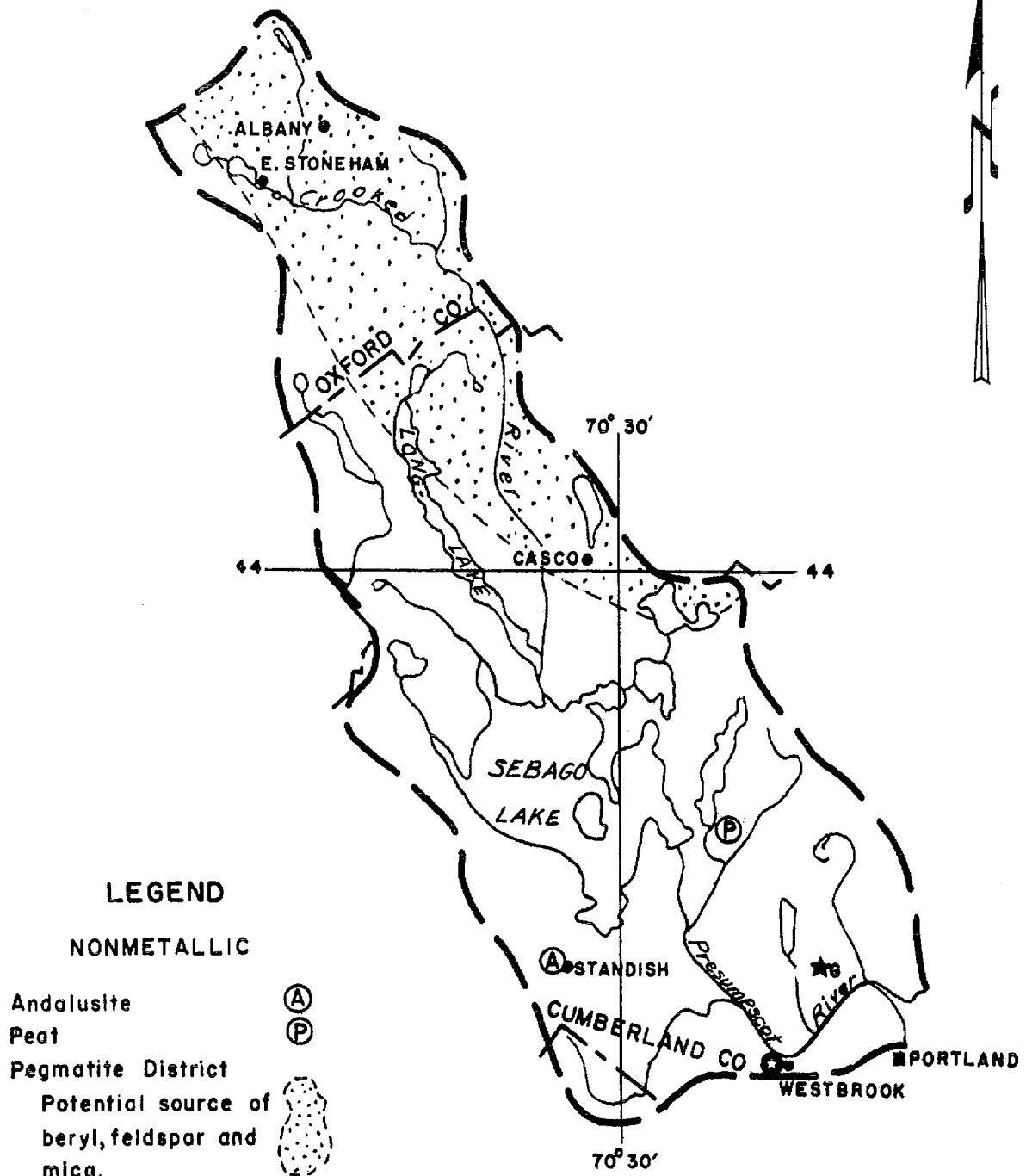
1. Deposits of clay, beryl, feldspar, mica, sand and gravel, and trap rock are now being worked in the Presumpscot River Basin. Andalusite, granite and peat occur, but there has been no production. No metallic minerals have been produced. Locations of mineral deposits are shown on Plate 14.

2. The bedrock in the northern part of the basin consists mostly of coarse-grained schist and some gneiss. In the central part it consists of granite and granitic rocks, and the southern part is underlain by fine-grained schist with quartzitic layers and interbedded metavolcanic rocks. Most of the productive pegmatites are irregularly distributed in the schist and gneiss of the northern area.

3. Much of the bedrock in the hilly and upland area is covered by till, a heterogeneous mixture of silt, sand, gravel, pebbles, cobbles, and boulders. In general, the till becomes progressively thicker seaward along the valley floors and is commonly covered by thick glacial outwash deposits of stratified sand and gravel. These outwash deposits occur in the form of terraces, outwash plains, and kames. They are the principal source of commercial sand and gravel. In places near the coast, marine clay overlies the outwash deposits.

4. Geologic data on the basin are inadequate. The basin was mapped in 1907 by Smith (1907, p. 7-12) as part of a reconnaissance survey of the granites of Maine. Several other reconnaissance surveys have been made: Leighton and Bastin (1908) and Leavitt and Perkins (1934) studied road materials, Bastin (1911) made a study of pegmatites (feldspar, quartz, mica, and gem deposits), and Katz (1917) worked on the stratigraphy of the coastal belt of schists. Detailed geologic maps of several mineral deposits in small areas have been made; otherwise, adequate geologic mapping (not yet completed) has been done only in the Bethel quadrangle, about one-fourth of which is in the Basin. The Preliminary Geologic Map of Maine (Keith, 1933) shows the geology, but this map is based in part on inadequate data.

5. During World War II the U. S. Geological Survey mapped pegmatite mines and prospects in the towns of Albany, Stoneham, and Waterford as a part of their pegmatite investigations in New England (Cameron and others, 1953). In 1950 the U. S. Bureau of Mines drilled 7 diamond drill holes in the Bumpus pegmatite in Albany Township south of Bethel (Neuman, G. L., 1952). The drilling disclosed an extension of the pegmatite body in which beryl and mica probably occur. Overburden conceals much bedrock, and it is doubtful if all valuable pegmatite deposits have been found and thoroughly prospected.



6. Goldthwait (1951, p. 24-34) mapped and sampled clays in the Basin and Trefethen (1945, p. 23-26) and others have studied the marine clays in Maine. Many of the clays are suitable for the manufacture of common and water-struck brick and tile. Laboratory work by Fuller (1949) suggests some Maine clays may be beneficiated by chemical treatment, but no commercial process has been developed.

#### MINERAL COMMODITIES

7. Andalusite.-- Andalusite occurs in the town of Standish, Cumberland County, Maine (Trefethen, 1943, p. 7). Large quantities of andalusite once were used in the manufacture of spark plug insulators, but it has been largely replaced by other minerals, especially kyanite which occurs "much more widely in deposits of commercial size than do other minerals of the group" (Tyler and Heuer, 1949, p. 784). The future of andalusite is thus related to the supply of kyanite. No andalusite was mined in the United States in 1949. India has supplied a large part of the high grade kyanite imported into the United States, but the quality has shown deterioration and the quantity allocated for export has been curtailed. The imports of British East Africa high-grade kyanite have fallen seriously due to depletion of the high grade reserves (Haw, 1954).

8. Clay.-- Clay occurs from the ocean to near the northwestern edge of Sebago Lake, about 24 miles inland (Goldthwait, 1951, p. 24-34). The exact boundaries of the clay deposits are not

known because many of them are covered by sand and gravel, and drilling would be necessary to delimit them. Most of the deposits are in the valley at altitudes of less than 300 feet. In the course of the special studies of the marine clays of this general area, 43 samples were analyzed by E. Cormier and found to average 39 percent clay,  $37\frac{1}{2}$  percent silt and  $23\frac{1}{2}$  percent sand. Of the clay-silt fraction alone 51 percent was clay. (Goldthwait, 1951, p. 25). Above the water table the clay is brown (the result of the presence of oxidized iron), and below the water table it is bluish gray (the result of the presence of reduced iron). Ceramics made from the clay are red because of the iron content. The clay also contains carbonaceous material that causes some products, such as paper fillers, to be gray instead of white. Unless the iron and carbonaceous material can be removed, the clay can be used only for brick, tile, pottery and fillers in which the red or dark color is not objectionable. Water-struck bricks are made from clay mined at Cumberland Center, about 8 miles north of Portland. Clay has been bleached in the laboratory (Fuller, 1949, p. 70-84), but no industrial process has been developed. The available information indicates that further investigation of the unworked clays is necessary before their use in the manufacture of structural clay products is undertaken.

9. Crushed stone.-- Two plants near Westbrook, a suburb of Portland, crush rock for use as concrete aggregate.

10. Peat.-- Several deposits of peat occur in the Presumpscot River Basin, but only two bogs appear to be of possible commercial significance. Both of these bogs are in Cumberland County, one near the town of Yarmouth, the other near the town of North Gorham. The bog near Yarmouth "should yield at least 250,000 tons of air-dried machine peat" (Bastin and Davis, 1909, p. 75). In the central part of the bog the peat is dark brown, somewhat fibrous, and well decayed. The North Gorham bog is small and of less commercial interest.

11. Pegmatite minerals (beryl, feldspar, mica, and quartz). Many pegmatites occur in the basin. Most of the deposits are in the northern part of the Basin in the townships of Albany and Waterford, Oxford County. In 1953 there were four active mines in the basin. The Perham mine near Noyes Mountain produces mica, beryl, and feldspar; beryl and mica were produced at the Pechnik mine near Albany and from a deposit at East Stoneham; and the B-B mine near Nubble Mountain produced mica. Massive white quartz, possibly the core of a pegmatite, near Cumberland Mills, Cumberland County, was once worked for pottery and filter materials (Bastin, 1911, p. 62). Important amounts of beryl, mica, and feldspar have been produced from the Bumpus Quarry in the town of Albany, but operations have been intermittent in recent years. Recent investigations including drilling by the U. S. Bureau of Mines and the U. S. Geological Survey of the Bumpus deposit indicated the presence of additional

reserves of these minerals in quantities sufficient to warrant further prospecting and development (Neumann, G. L., 1952). At present (1953) the quarry is inactive and flooded. In the township of Albany during World War II small quantities of mica, feldspar, and beryl were produced from several pegmatites that were worked principally for mica and feldspar but little strategic sheet mica was produced. A number of deposits in the basin are being investigated on a limited scale by private companies with some favorable results.

12. In most pegmatite bodies only small amounts of mica and beryl crystals are recovered in comparison to the amount of rock mined. For this reason, in recent years when worked for beryl and mica, the deposits have been profitably mined only under conditions of high prices and governmental assistance. When pegmatites are mined for feldspar, mica and beryl may be produced as byproducts and relatively long-term operations may result. It is unlikely that many pegmatite deposits in the Presumpscot River Basin will be worked to any great extent under normal peacetime conditions unless large and high grade deposits are found, or the prices of beryl and mica remain equal to, or become greater than, the "support" prices of 1953.

13. Sand and gravel.-- Abundant glacial deposits of sand and gravel occur in the basin. The deposits probably contain reserves of sand and gravel sufficient to meet the foreseeable

local demands for concrete aggregate, road metal, and similar materials. However, much of the sand and gravel is too soft, or weak, for high-grade road material or concrete aggregate (Leavitt and Perkins, 1934). Washing and grading should improve the quality of the products of many of the deposits. No deposits of sands suitable for special uses have been reported, but, as in adjoining basins, prospecting might lead to the discovery of such sands in sufficient quantities to warrant their development.

#### MINERALS PLAN

14. The minerals plan for this basin is as follows:

- a. Complete geological mapping of quadrangles in the basin at a scale of 2 inches to the mile (1:31680).
- b. Conduct further field and laboratory investigations of the marine clays.
- c. Conduct careful investigations of pegmatite bearing areas as part of an intensive pegmatite survey of the region.

## SELECTED BIBLIOGRAPHY

- Bastin, E. S., 1911, Geology of the pegmatites and associated rocks of Maine: U. S. Geol. Survey Bull. 445.
- Bastin, E. S., and Davis, C. A., 1909, Peat deposits of Maine: Geol. Survey Bull. 376, p. 1-27.
- Boardman, Leona, and Watson, Elaine, 1949, Geologic map index of Maine. U. S. Geol. Survey.
- Fuller, E. W., 1949, Improving the quality of Maine clays, in Trefethen, J. M., Report of the State Geologist 1947-1949, p. 70-84: Maine Devel. Comm.
- Goldthwait, Lawrence, 1951, Marine clay of the Portland-Sebago Maine region, in Trefethen, J. M., Report of the State Geologist 1949-50, p. 24-34: Maine Devel. Comm.
- Haw, V. A., 1954, Canadian Institute M & M Eng. Transactions, v. LVII, p. 25-33.
- Katz, F. J., 1917, Stratigraphy of southeastern Maine: U. S. Geol. Survey Prof. Paper 108, p. 165-177.
- Keith, Arthur, 1933, Preliminary geologic map of Maine: Maine Geol. Survey.
- Leavitt, H. W., and Perkins, E. H., 1934, A survey of road materials and glacial geology of Maine: Maine Technology Expt. Sta. Bull. 30, vols I and II.
- Leighton, H., and Bastin, E. S., 1908, Road materials of southern and eastern Maine: U. S. Bur. of Public Roads Bull. 33.
- Miller, Robert, and Wing, Lawrence, 1945, Appendix A, in Trefethen, J. M., Report of the State Geologist 1943-44, p. 29-60: Maine Devel. Comm.
- Neumann, G. L., 1952, Bumpus pegmatite deposit, Oxford County, Maine: U. S. Bur. Mines Rept. Inv. 4862, p. 1-15.
- Riddle, F. H., and Foster, W. R., 1949, The sillimanite group, in Dolbear, S. H., and others, Industrial minerals and rocks, 2d ed., p. 893-919: The Am. Inst. of Min. and Metall. Eng.

- Smith, G. O., 1907, the occurrence of granite in Maine: U. S. Geol. Survey Bull. 313, p. 7-12.
- Trefethen, J. M., 1943, Report of the State Geologist 1942-1943: p. 7, 9, Maine Devel. Comm.
- Trefethen, J. M., 1945, Report of the State Geologist 1943-1944: Maine Devel. Comm., p. 23-26.
- Trefethen, J. M., and Bradford, R. B., 1944, Domestic fuel possibilities of Maine peat: Maine Geol. Survey Bull. 1, p. 1-47, Maine Devel. Comm.
- Tyler, P. M., and Heuer, R. P., 1949, Refractories in Dolbear, S.H. and others, Industrial minerals and rocks, 2nd ed., p. 484: The Am. Inst. of Min. and Metall. Eng.

## SECTION XIII - INSECT CONTROL

1. This section provides information on the present status of certain insect-borne diseases, insect disease vectors and pest insects; data to determine the need for and approximate costs of control programs; the benefits that may accrue from such control programs. Insects adverse to public health are considered in two categories: (1) those that are capable of the role as disease carriers (vectors), (2) those pest insects that reduce the physical efficiency and comfort of man and affect his economic status.

### PRESENT STATUS OF INSECTS ADVERSE TO PUBLIC HEALTH AND THEIR CONTROL

2. Disease and vector problem. - Malaria has probably never been endemic in the basin despite the presence of war veterans who returned with the disease. Anopheles quadrimaculatus, the malaria vector, occurs in moderate numbers in the basin. Malaria, however, is not considered a public health problem.

3. Eastern equine encephalitis is not known to be a public health problem in the basin. Several species of mosquitoes, occurring in the basin, which may be implicated in the possible transmission of the disease are: Aedes vexans, A. sollicitans, A. triseriatus, A. atropalpus, Mansonia perturbans and Culiseta melanura. One or more of these species is common in a wide variety of habitats.

4. Rocky Mountain spotted fever, a tick-borne disease, has not been reported as having been acquired within the basin although the vector, Dermacentor variabilis, is endemic in certain portions of the basin.

5. Tularemia is believed endemic in at least one location in Maine and may occur in the basin, but is not common in man and is not considered to be of public health importance at the present time as an insect-borne disease. One endemic focus has been reported as the result of a case contracted from a wild animal at Kokadjo Lake, Maine. It is transmitted to some extent in other parts of the country by ticks, deer flies and certain other biting insects, but there are no records to indicate such transmission to man in this basin. Many species of deer flies are common in this basin, but none which occur here have been implicated in the transmission of tularemia.

6. The pest insect problem. - Insect pests of public health importance occur throughout the basin. The principal pest insects are the mosquitoes, ticks, black flies, deer flies and horseflies, and punkies. The problems regarding these pest insects vary from place to place and also seasonally.

7. Mosquitoes. - There are approximately 31 species of mosquitoes known to occur in the basin, of which 21 are ordinarily troublesome as pests.

8. A number of early spring Aedes develop in temporary pools in forest and grassland in early spring and are important pests. The principal species are A. aurifer, A. communis, A. exorucians, A. fitchii, A. implacabilis, A. intrudens, A. punctor, A. stimulans and A. trichurus. They are pests principally during the day and early evening. Temporary pools favorable for development exist over a considerable portion of the basin.

9. A few Aedes mosquitoes develop not only in the spring in temporary pools but also develop intermittently or continuously throughout the summer in certain other types of water. Aedes canadensis and A. cinereus are important pests in this category. Two additional species, A. sticticus and A. vexans, develop in numbers in isolated pools following receding floods. A. vexans is the major pest of this group, not only because it migrates considerable distances from its place of development but also because it develops in enormous numbers and has an unusually wide range of breeding places.

10. Aedes sollicitans, the salt marsh mosquito, develops along the coast in salt marshes flooded by excessively high or moon tides. A. cantator breeds in bordering brackish pools. These are produced in relatively small numbers because of the small amount of salt and brackish water within the basin.

11. The northern house mosquito, Culex pipiens, is an urban pest of moderate intensity throughout the summer months, biting throughout the summer months, biting during the evening and at night. It develops in barrels, cans, fish pools, quarries, street drains and in slow-flowing streams and ponds polluted with garbage, sewage and other filth. Mansonia perturbans may be a bad pest during the summer.

12. Ticks. - The American dog tick, Dermacentor variabilis, is moderately abundant in the Sebago Lake and Casco regions, and very locally and sparsely distributed along the small portion of the basin near the coast.

13. Black flies. - Three species of black flies, Prosimulium hirtipes, Simulium venustum and S. tuberosum, are the principal pests of this group, although about 14 species are known from Maine. They develop solely in flowing streams, principally in fast-flowing streams. They are not troublesome in the hilly, upper reaches of the basin.

14. Deer flies and horseflies. - A large number of species of deer flies and horseflies occur in the basin. A number of species of the genus Chrysops (deer flies) are pests during the daytime, inflicting painful bites. They are solitary in habits and ordinarily not many attack at one time. They do not constitute a public health problem equal to that produced by the mosquitoes.

15. Punkies. - Punkies, principally Culicoides obsoletus, are bad pests in the northern part of the basin. Biting occurs predominantly in late afternoon. In heavily-infested areas, they bite by the hundreds and in these densities create a public health problem. Little is known about the habitat in which they develop.

16. The active insect season varies from approximately 110 days in the extreme northern end of the basin to 150 days at the coast. The biting insects of major importance have a season extending from early to late May through late July or early August followed by a rapid decrease, thereafter, and terminating by late August or early September. During this period, the mosquitoes reach their greatest numbers in late May, June, and July. The black flies first appear in late May or early June and continue principally through late June and July. Ticks occur during late April or early May, June and early July. Punkies appear principally in late June and July.

17. Table 31 gives a summary of representative collection sites and approximate densities of the important pest species in the basin.

Table 31 - Approximate densities of important pest species,  
Presumpscot River Basin

Locality	Mosquitoes	Black flies	Deer flies	Punkies	Greenheads	Ticks
Raymond	5	-	-	-	-	-
Harrison	5	-	-	-	-	-
Sebago Lake	5	4	4 or 5	4	-	2
South Casco	5	-	-	-	-	-
Bridgton	5	4	-	-	-	-
Casco	5	-	4 or 5	-	-	2
Naples	5	4	4 or 5	4	-	-
Lynchville	5	4	4 or 5	-	-	-
Cumberland Center	5	4	-	-	1	1
Westbrook	5	3	-	3	-	-

18. The figures in Table 31 represent the estimated relative density of the pest-insect population. Number ten would represent the maximum number of pest insects encountered in any given area in the entire New England-New York area; such conditions represent unbearable situations. Zero represents no insects or extremely light insect populations.

19. Table 32 lists representative population centers where the intensity of the problem is believed severe enough to warrant consideration of pest control.

Table 32 - Population centers where organized insect control programs may be desirable,  
Presumpscot River Basin

Locality	Intensity of problem	Insects primarily causing problem	General type of control
Bridgton Ctr.	4 or 5	Mosquitoes	Larviciding and/or ditching
Westbrook	5 or 6	Mosquitoes	Larviciding and/or ditching
Cumberland Ctr.	4 or 5	Mosquitoes	Larviciding and/or ditching
Sebago Lake State Park	5 or 6	Mosquitoes	Larviciding and/or ditching

20. The figures in Table 32 represent the approximate intensity of the pest-insect problem based upon relative density of the insects, as well as upon the size of the population to be protected and the type and extent of the control work involved. Number ten would represent the worst problems in the New England-New York area where conditions would be unbearable. Zero would represent no insect attacks or only very rare annoyances. Between five and six represents the point at which possibility of a control program is ordinarily believed worthy of consideration. However, these data give only a basis for generalizations on area pest problems.

Additional site surveys will be required by competent personnel for determination of necessity and type of control program. During late May, June and early July, data indicate that the pest insect populations are at a level at which residents and vacationists at camps and resorts must seek protection against their attacks. The major accomplishments from control work would be toward the comfort of the local residents, but an increase in recreational income may also be expected. No organized control programs appear feasible in the sparsely-populated portions of the basin. An added influx of tourists may be expected as a result of insect control measures where the problem presently discourages visits to many vacation areas. Owners of camps and resorts will often find it profitable to consider limited control work such as temporary adulticiding, larviciding or ditching in the immediate vicinity of their property.

21. Some control projects have been undertaken to a limited extent around camps and resorts in the vicinity of Sebago Lake. These projects were of a temporary nature, resorting usually to airplane adulticiding. In 1951 an experimental tick control program was initiated in the vicinity of Casco and Sebago Lake. The results of this work were reported to be very favorable.

## BENEFITS AND COSTS OF INSECT CONTROL

22. Because no known organized projects have been in operation in any of the urban or suburban communities in this basin from which costs and benefits can be calculated, estimates must be based on applicable data from the nearest control areas where such evaluations have been made.

23. The annoyance produced by biting insects in this basin and other portions of northern New England are so well-known that they need not be reviewed. However, the problem of specifically evaluating the influence of pest insects in the basin is difficult. Public health insect control benefits are generally classified as intangible benefits. These are difficult or impractical to measure in terms of accurate monetary benefits. It is highly improbable that accurate data can be obtained on medical expenses and man-hours of work lost as the result of insect attacks. It is even more difficult to assign monetary evaluation to benefits derived from the mere freedom from insect attacks by the inhabitants and workers in the basin where no actual medical expense or work loss is involved, although these benefits are probably the most important of all.

24. Insect attacks affect recreational income by a reduction of the tourist season and by a reduction in the full use of recreational facilities. A possible means of partially evaluating

tangible monetary benefits can be made with some degree of accuracy by a measurement of these effects of insect attacks upon the recreational income. Numerous inquiries to resort owners, State park superintendents, residents, etc., as well as studies made in other localities, indicate that a 5-percent increase in patronage may be expected after the biting insect problem is lessened and time is allowed for this information to reach the prospective tourists. A yearly average cost for temporary pest insect control in rural camps and resorts is estimated to be \$300 per unit over a period of years. The total cost for insect control in the known 80 camps in the vicinity of Sebago Lake will, therefore, amount to approximately \$24,000. The yearly average cost of insect control where organized community projects could be operated is estimated to be \$2,000 over a period of years. Experimental tick controls in 1952 and 1953 proved to be very effective. The total sum expended to control this pest in approximately 1,200 acres amounted to \$4,600. To continue this work in other localized areas in the basin will cost approximately \$1,000 per year. On an experimental basis tick control costs are estimated to be \$1.80 per acre. However, this sum is believed to be low inasmuch as the work was done by the State. Commercially, the cost figure will be somewhat higher.

## EFFECTS OF WATER RESOURCES DEVELOPMENTS ON INSECTS

25. Development of recreation areas. - The central lake district and more specifically Sebago Lake is the most popular recreational area in the basin, and one of the most intensively utilized in the State of Maine. Recreational plans call for additional public areas and facilities. In developing recreational areas, proper consideration should be given to the areal relationship of these areas to potential insect breeding areas and to the effect of insect pests upon visitor use. When new areas are developed, they should be located insofar as possible where public health insect production potential is low and where control can be effectively instituted when necessary without undue adverse effect upon wildlife.

26. Development of additional marsh areas for wildlife along the Northwest River does not appear desirable from the standpoint of the potential insect breeding areas. Sebago State Park is within the flight range of many species of mosquitoes which would breed in these marshes. An increase in insect production because of new breeding areas would discourage the full use of recreational developments along this lake.

## CONCLUSIONS

27. It is concluded that:

a. Vector-borne diseases do not constitute a public health problem at the present time although vectors of several human diseases are present.

b. Of the many pest-insect groups present in the basin, the mosquitoes constitute the principal pest problem in the urban and recreational areas. All other groups of pest insects reach densities which constitute a problem in many rural camps and resort areas. Control work in these instances would materially reduce these pests.

c. The yearly average cost to control mosquitoes in urban areas over a period of years is estimated to be \$2,000. Cost of tick control in selected areas is estimated to be \$1,000 per year. Yearly cost for pest-insect control in camps and resorts is estimated to be \$300 per camp or resort, or a total of \$24,000 for the known camp sites.

d. Benefits derived from pest-insect control are primarily intangible in nature. However, it is estimated that a 5 percent increase in recreational income could be expected as a result of pest-insect control in resorts and camps.

e. Entomological surveys should be conducted for new or redeveloped recreational sites as the actual plans for development take place.

## INSECT CONTROL PLAN

28. The plan for the control of insects adverse to public health is as follows:

a. Conduct or continue studies and investigations especially of black flies, deer flies and punkies and provide consultation service to guide control programs.

b. Advise resorts, camps and other recreational interests, and urban communities with an insect-pest problem to seek the technical guidance of trained and experienced personnel before initiating control measures.

c. Provide for preventive and control measures against vector and pest insects in the planning and construction stages of water resource developments, especially when such developments would be located within three miles of existing or anticipated centers of population or recreational areas. In the event potential hazards are found inherent in the development of a project, the planning agency and the agencies concerned with the control of insects adverse to public health should (1) select appropriate measures for prevention or control of such hazards and (2) insure the carrying out of required measures by making necessary provisions in the project.

d. Maintain limited entomological surveillance periodically at certain development sites to determine the effects of the project and its operation and maintenance on insect populations,

and to determine when additional insect control measures may be necessary.

e. Provide aid in the evaluation of the vector and pest insect problems in connection with projects or programs within a state or on Federal property.

f. Provide assistance to planners of recreational areas so that insofar as practical and possible, these areas would be located where the vector or pest insect production potential is low and where control can be effectively instituted when necessary without undue adverse effect upon wildlife; and so that wildlife areas of a type conducive to insect production would be located preferably three miles or more from recreational areas and urban and suburban developments.

## SECTION XIV - COORDINATED BASIN PLAN

### GENERAL DISCUSSION

1. The basin of the Presumpscot River is sparsely populated. About 12 percent of the total area of 648 square miles is covered by lakes and streams and nearly 70 percent is wooded. Only three of the centers of population have more than 4,000 inhabitants and most of the communities have fewer than 2,000. However, the basin does include a part of the city of Portland, which is the largest city in Maine. The basin is a popular resort area and income from businesses serving the needs and desires of recreation seekers is the keystone of the economy.

2. The recreational activities in the basin are largely dependent upon natural resources which include the lakes and streams, most of which have waters of naturally high quality; the fish and wildlife in good habitat areas; and the scenic hills and forests. For the continued healthy growth of the basin's economy, measures are needed to protect and to increase the utility of these resources. Needs in other fields, in general, are tied to some form of recreational use. Development and management needs for the basin's resources are set forth in the following paragraphs.

3. Storage and stream flow regulation. - The existing useful storage in this basin amounts to 285,500 acre-feet, of which nearly 80 percent is in Sebago Lake. The development of additional storage is not warranted at this time.

4. water supply. - A great surplus of water suitable for all general water uses will be available for water supply for this basin for at least the next fifty years on the basis of needs now foreseeable. The source of most of this surplus is surface water. However, ground water developments for rural homes and farmsteads are at times not adequate to meet the demands for domestic and agricultural water with no allowance for irrigation. More detailed information is needed on the occurrences and best methods of obtaining ground water. The use of water for supplemental irrigation may become important in the future and trends in this type of water use should be observed so that orderly adjustments may be made if irrigation begins to compete with other water uses.

5. Pollution control. - A great majority of the surface waters in the basin receive no pollution. Highland Lake, Long Lake and the Bay of Naples do receive pollution, but the effects are confined to the immediate vicinity of the sewer outlets. In the upper basin, Stevens Brook is the only stream in which the water quality is not always suitable for purposes requiring high water quality. In the lower basin, the quality of waters of Tannery Brook and the North Branch of Little River is deteriorated by pollution. The most seriously deteriorated waters in the basin are in the lower eight miles of the main Presumpscot River, between Westbrook and Casco Bay, where the water during critical periods is in nuisance condition and of a quality generally unsuitable for any purpose.

6. Flood control and drainage. - The series of natural and artificial lakes above the outlet of Sebago Lake provides almost complete control of the run-off from more than 70 percent of the total basin. This control gives a high degree of flood protection. Flood damages have been negligible and no flood problem areas are known to exist. There are no drainage problems.

7. Power development. - Nearly all of the available head in the Presumpscot River has been developed for power purposes, and studies have revealed no new sites either on the main stream or on tributary streams at which the development of power is feasible. The existing public utility power plants are part of the interconnected system of the Central Maine Power Company.

8. Navigation. - There is no record of commercial navigation on the Presumpscot River. Future improvements for navigation, if found justified, would undoubtedly be confined to the tidal reach of the river.

9. Fish and wildlife. - Fish and wildlife are abundant throughout the basin; however, hunting and fishing pressure is perhaps greater here than in any other basin in Maine. These resources require careful management and expanded development.

10. Recreation. - The resources of the basin are used extensively in connection with recreational activities including picnicking, camping, hiking, fishing, swimming, canoeing, hunting, nature study and winter sports. The needs of the growing population in and near the basin for non-urban recreation, together with the steadily

increasing pressure from tourists, sportsmen, and vacationists, call for the development of additional recreation areas and facilities, and the expansion of existing areas.

11. Land management. - From the standpoint of both agricultural and forest land management, the Presumpscot River Basin is considered to be an integral part of the Maine Coastal Area. Therefore, the needs with regard to land management are discussed in Section XI of Chapter X, Maine Coastal Area.

12. Minerals. - Geologic data on the Presumpscot River Basin are inadequate. Detailed geologic mapping and other surveys and investigations are needed to reveal the full mineral potential of this basin, especially with regard to pegmatites and marine clays.

13. Insect control. - Several species of insects create a pest problem in the basin. Mosquitoes are the major offenders, but ticks, horseflies, deer flies, black flies and punkies are also a source of annoyance and discomfort in many parts of the basin. There is a need for further study of this problem, and for the application of local control measures.

## VIEWS OF LOCAL INTERESTS

14. A public hearing was held in Augusta, Maine on June 12, 1952, to afford local interests an opportunity to express their views with reference to the procedures and objectives of the regional survey, and to bring to the attention of the Committee any resource problems which the Committee should consider during the course of the survey. Those who appeared generally favored state and local participation in matters dealing with the resources and were of the opinion that Federal participation should be limited to the fields of planning and research. General requests were made for erosion control.

14a. When the survey was nearing completion and tentative findings of the Committee had been drafted, additional public hearings were held in order that the Committee might obtain the views of interested parties on the tentative findings. Public hearings on this chapter and other chapters on the river basins of Subregion "A" were held at Berlin, New Hampshire on November 10, 1954, and at Augusta, Maine, on November 11, 1954.

14b. Those who appeared made no comments which dealt specifically with the content of this chapter. Comments of general applicability to all the river basins of Subregion "A" are summarized in Chapter II. The views expressed by those who appeared and the views expressed in written statements have been considered by the Committee in the preparation of the report.

## FEATURES OF THE COORDINATED BASIN PLAN

15. Upon the basis of the inventory of the land, water and related resources of the Presumpscot River Basin and the measures required for their conservation, development, and utilization, a Coordinated Basin Plan is presented below. The details of the several measures are set forth in Sections III to XIII, inclusive, of this Chapter. The principal features of the Coordinated Basin Plan are as follows:

a. Storage and stream flow regulation.

No projects for storage and stream flow regulation.

b. Water supply.

(1) Investigation of the extent and quality of ground water sources and the most economical method of obtaining dependable supplies. Estimated cost between \$15,000 and \$20,000.

(2) Initiation of a study of the trends in water demand for supplemental irrigation. Estimated annual cost approximately \$500.

c. Pollution control.

Installation of facilities for treatment or disposal of municipal and industrial wastes along the lines of Provisional Plan C as described in Section V and summarized below. Estimated total first cost \$1,770,000.

(1) Sewage disposal facilities consisting of: three primary and one secondary treatment facilities; six subsurface disposal systems; and one connection to a municipal sewer.

(2) Industrial waste treatment facilities at four (4) manufacturing plants.

d. Flood control.

(1) No projects specifically for flood control. Some reduction of peak run-off would result from the land treatment features of the Coordinated Basin Plan.

(2) Improvement of the warning service to give timely notice of flood threats.

e. Power development.

No projects for hydroelectric power development.

f. Navigation.

No improvements for navigation.

g. Fish and wildlife.

(1) Careful management of the deer herds in the basin.

(2) Investigation of sites offering possibilities of small marsh development for waterfowl and fur bearers.

(3) Continuation of lake surveys to increase the information necessary for fishery management.

No estimate of cost of the fish and wildlife features of the Coordinated Basin Plan has been made.

h. Recreation.

(1) Expansion of facilities at Sebago Lake State Park and excavation of an archeological site within the park to furnish materials for a museum. Estimated total cost \$300,000.

(2) Acquisition and development of approximately 500 acres of land for public park and recreation purposes in the central lakes district. Estimated cost \$500,000.

(3) Development of a site on the shore of Keewaydin Lake for picnicking, camping, swimming and hiking. Estimated total cost \$50,000.

(4) Establishment of ten campsites along existing canoe routes. Minimum facilities should include one or two picnic tables, a fireplace, and sanitary facilities at each site. Estimated total cost \$6,500.

(5) Improvement of existing wayside areas and development of one or two additional ones. Estimated total cost <sup>\$5,000</sup> \$6,500.

(6) Establishment of scenic overlooks and protected scenic routes in connection with the present program of highway improvement. The cost of this feature has not been estimated.

i. Land management.

See Sections XI and XIV of Chapter X, Maine Coastal Area.

j. Minerals.

(1) Completion of geological mapping of quadrangles in the basin at a scale of two inches to the mile.

(2) Investigation of marine clays in the field and laboratory.

(3) Investigation of pegmatite-bearing areas.

No estimate of costs of the minerals features of the Coordinated Basin Plan has been made.

k. Insect control.

(1) Investigations to determine best methods for controlling the pest insects found in this basin. The cost of this feature has not been estimated.

(2) Coordination in the planning of locations for recreation areas and fish and wildlife areas so that measures taken for the control of insects at recreation areas will not adversely affect fish and wildlife, and so that the creation of wildlife areas will not cause insect pest problems at recreation areas. The cost of this feature has not been estimated.

(3) Institution of control measures in urban areas.  
Estimated average annual cost ~~per community~~, \$2,000.

(4) Institution of control measures in rural camps and resorts. Estimated annual cost \$300 per unit.

APPRAISAL OF THE COORDINATED BASIN PLAN

16. The appraisal of the Coordinated Basin Plan is influenced by the fact that the plan is offered as an inventory of possibilities rather than as a definite program for implementation in accordance with a specified time schedule. Monetary values have been assigned to benefits which can be identified and measured. Intangible benefits are described. Cost estimates are based on 1949 prices and annual charges include amortization, interest, maintenance and operation. The amortization period is taken as the anticipated useful life of structures or the average tenure of

landowners. In general, the interest rate is taken at  $2\frac{1}{2}$  percent for public works and 4 percent for private works. The annual costs of features of the plan which are of a private nature are based on private financing, while features that would normally be provided by municipal, State or Federal agencies are based on public financing.

17. Water supply. - The benefits from the water supply investigations included in the Coordinated Basin Plan are intangible but the findings would help users of rural ground water by indicating source areas and economical methods of obtaining an adequate supply for domestic purposes. The study of supplemental irrigation would give warning when this use threatens to infringe upon other water uses. The estimated total cost of the ground water study is between \$15,000 and \$20,000. Annual cost of the supplemental irrigation investigations is approximately \$500.

18. Pollution control. - The pollution control features of the Coordinated Basin Plan would improve the water quality of the now polluted reaches of streams. In addition to increasing aesthetic values and reducing the chances of waterborne diseases, pollution control measures, in the lower basin, would increase the utility of the waters for industrial processing; and could lead to the reopening of clam flats near the mouth of the Presumpscot River. The benefits of pollution control have not been assigned a monetary value. The total first cost of the pollution control measures

would be \$1,770,000 and the annual charge \$218,000 for ten years after which it would be \$60,000.

19. Fish and wildlife. - The fish and wildlife features of the Coordinated Basin Plan would provide for correction of existing abuses and deficiencies of the basin's fish and wildlife resources. These improved conditions would attract to the area additional sportsmen whose expenditures would add to the income of residents catering to sportsmen. The costs have not been estimated.

20. Recreation. - Both tangible and intangible benefits would result from further development of the resources along the lines of the recreational features of the Coordinated Basin Plan. Tangible benefits are represented by monetary expenditures of visitors patronizing the recreation resources, areas and facilities. The benefits attributable to the plan are estimated to be about ten percent of the estimated increase in gross annual expenditures, or about \$100,000. Annual charges are estimated at \$74,550, giving a benefit-cost ratio of about 1.3:1.

21. The intangible benefits of the recreation features of the plan are very large because of the great numbers of persons benefited. They consist of the improvement in physical and mental well-being of the vacationist that has always been recognized as the prime purpose in the development of outdoor recreational facilities.

22. Minerals. - The minerals features of the Coordinated Basin Plan would complete quadrangle geologic mapping, would indicate the location of probable mineral deposits of commercial value and would

determine best uses of clay beds. The benefits are not capable of monetary evaluation but they would be of assistance to engineers, miners and prospectors and might result in the inauguration of profitable new industries.

23. Insect control. - The insect control features of the Coordinated Basin Plan would make it possible for camps, resorts and communities to control insect pests and disease vectors. While the benefits are not capable of monetary evaluation, they would make life more comfortable for residents and visitors and indirectly benefit the recreation industry by encouraging vacationists to stay longer and return.

#### RECOMMENDATION

24. The Committee recommends that the Coordinated Basin Plan, as heretofore described, serve as a guide for the development, conservation and use of the land, water and related resources of the Presumpscot River Basin.